Minerals Yearbook 1969

Volume IV

AREA REPORTS: INTERNATIONAL

Prepared by staff of the
BUREAU OF MINES

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UNITED STATES DEPARTMENT OF THE INTERIOR • Rogers C. B. Morton, Secretary

BUREAU OF MINES • Elburt F. Osborn, Director

Created in 1849, the Department of the Interior—America's Department of Natural Resources—is concerned with the management, conservation, and development of the Nation's water, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that parks and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States—now and in the future.

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Foreword

This edition of the Minerals Yearbook provides a record of performance of the world's minerals industry during 1969. It continues the Federal Government's historical record of mineral industry developments, begun on an annual basis in 1882. The intervening 88 years have seen this report grow from a one-volume publication devoted principally to domestic activities to three books encompassing global mineral industry developments. The general content of the individual volumes is as follows:

Volume I–II, Metals, Minerals, and Fuels, contains chapters on virtually all metal, nonmetal, and mineral fuel commodities important to the domestic economy. In addition, it includes a general review chapter on these industries, a statistical summary, and chapters on employment and injuries and on technologic trends.

Volume III, Area Reports: Domestic, contains chapters covering the mineral industry of each of the 50 States, the U.S. island possessions in the Pacific Ocean and the Caribbean Sea, the Commonwealth of Puerto Rico, and the Canal Zone. This volume also has a statistical summary chapter, identical with that in Volume I–II, and a chapter on employment and injuries.

Volume IV, Area Reports: International, presents the latest available mineral statistics for more than 130 foreign countries and areas and discusses the importance of minerals to the economies of these nations. A separate chapter reviews minerals and their relationship to the world economy.

The Bureau of Mines will continue its efforts in the years ahead to increase the Yearbook's value to its many users. Toward that end, the constructive comments and suggestions of readers will be most welcome.

ELBURT F. OSBORN, *Director*

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Acknowledgments

The Bureau of Mines gratefully acknowledges the statistical data and other basic information on mineral production, consumption, and trade which were provided by various foreign government mineral and statistical agencies through a variety of official publications. Useful data were also obtained from publications of the United Nations, from airgrams of the Department of State, and from both the domestic and foreign technical and trade press. Particularly helpful in the preparation of this volume were the routine and special reports received from mineral, petroleum, and technical attachés and other members of the embassy and consular service of the Department of State, and their contributions are appreciated.

The individual chapters of this volume were prepared by the staff of the mineral supply activity with contributions from various members of the Foreign Service. Final correlation and checking of this volume was performed by the staff of the Office of Technical Data Services.

The regimes of some of the countries reviewed in this volume are not recognized by the U.S. Government. The information contained herein is technical and statistical and is not to be construed as conflicting with or contradictory of U.S. policies toward these countries.

ALBERT E. SCHRECK,
Editor-In-Chief

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Minerals in the World Economy

By Charles L. Kimbell [1]

Geared to the continued growth in world industrial and economic activity, overall world output, trade and consumption of most mineral commodities continued to increase in 1969. In fact, output of several major mineral commodities apparently advanced more rapidly than did overall industrial production. The United Nations index of industrial production for 1969 stood at 150 (base: 1963=100)—10 index points, or 7.1 percent, higher than the 1968 level of 140. In contrast, world output of ingot steel and steel castings advanced 8.4 percent between 1968 and 1969, while world crude oil output moved upward by 7.9 percent. These commodities, although not necessarily barometers of overall mineral production growth, are most significant in that they are the leading mineral products in terms of total dollar value of world output. It should be noted also that these pronounced upturns in output are not simply short term upswings—crude steel output advanced by 7.2 percent in 1968 over that of 1967, while 1968 crude oil output was 9.4 percent greater than in 1967.

It is significant that despite these increases in production (and many others as well), prices for many commodities advanced appreciably during 1969. Only part of these price increases could be attributed to increasing costs of production, processing, and shipping. Despite production increases, demand continued to rise, and in some cases, growth in the latter exceeded the growth in output, stimulating price increases.

Among mineral commodities traded, crude oil continued to be the overwhelmingly dominant single commodity in 1969, and as such, some indication of the quantity moved and direction of movement seems in order. While complete 1969 data comparable to those provided for 1968 later in this chapter are not yet available, total crude oil exports may have reached 1,100 million tons or more in 1969. Preliminary and partial tabulations of world 1969 crude oil movement record the shipment of 905 million tons, distributed as follows, by general area of origin:

Exporting area	Share of total (percent)		
	1967	1968	1969
Near East	51.0	51.0	50.5
Caribbean	18.5	16.7	15.1
North Africa	13.2	17.1	18.2
U.S.S.R. and other Communist Europe	6.0	5.5	4.7
Other	11.3	9.7	11.5
Total	100.0	100.0	100.0

Source: The British Petroleum Company, Ltd. Statistical Review of the World Petroleum Industry for 1967, 1968, and 1969.

Most significant in the tabulation is the continued decline of the Caribbean area—most prominently of Venezuela—as a source. Also worthy of note are the continued growth of North Africa and the inability of the U.S.S.R. and other Communist Europe to retain their percentage share, despite efforts to expand such trade in recent past years.

The following tabulation lists the percentage distribution of the same 905-million-ton partial 1969 export total on the basis of principal destinations:

Importing area	Share of total (percent)		
	1967	1968	1969
West Europe	50.5	50.3	51.6
United States	14.6	14.5	14.5
Japan	13.5	15.0	15.1
Other	21.4	20.2	18.8
Total	100.0	100.0	100.0

Source: The British Petroleum Company, Ltd. Statistical Review of the World Petroleum Industry for 1967, 1968, and 1969.

Most significant here is the sharp upturn in the West European share, the continued increase in the Japanese share, the relative stability of the U.S. share, and the conse-

[1] Physical scientist, Bureau of Mines, Washington, D.C.

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quent decline in the share accounted for by other Nations—this despite the considerable expenditures of the world petroleum industry for refineries in less developed countries.

Aside from the crude oil trade, there is a growing trade in refinery products. Based on available 1969 information and extrapolating from 1968 results that are fairly firm, 1969 total world exports of petroleum refinery products for fuel use (excluding lubricants, petrochemical feedstocks, and other similar nonfuel products) probably approached 330 million tons.

As in the case of petroleum, comprehensive and complete data on the 1969 steel trade were not available at this writing, but preliminary 1969 data for 22 countries including Canada, the United States, the nations of the European Economic Community (EEC) and European Free Trade Association (EFTA), Japan, and several others (excluding most prominently the U.S.S.R.) indicate a growth of over 3 percent in trade of steel ingots and semimanufactures; if projected to cover the 29 steel-exporting nations listed in table 47 of this chapter, this figure would give an aggregate export of the order of 75,600,000 tons for 1969.

The two major areas of international hostilities—Southeast Asia and the Near East—continued to influence mineral commodity supply patterns in 1969. In Southeast Asia, the continued presence of U.S. forces in South Vietnam, with the necessary attendent support and supply facilities, even at the reduced levels relative to those of 1968, raised that area's requirements for imports of refined petroleum and certain other mineral commodities, such as cement, considerably above the level needed to support the indigenous population. In the Near East, continued interdiction of the Suez Canal as a route for Near East crude oil to European markets had essentially been compensated for by increased shipments around the Cape of Good Hope and by swelling North African output, but further dislocations resulted when terrorist activity interrupted pipeline movement of Near East crude in its overland journey to the Mediterranean.

In Africa, suppression of the breakaway Biafran area of Nigeria by the central Government contributed to a degree of stabilization for the mineral industry of that civil-war-torn nation. Elsewhere in Africa, continued embargo of Rhodesian products including, most significantly among minerals, chromite, had a minor overall influence on total mineral trade. In the case of chromite, the embargo stimulated output elsewhere, and hence continued to influence trade patterns in this commodity.

Space limitations preclude any detailed review of the world's 1969 mineral reserve situation on a commodity-by-commodity basis, and data are insufficient to determine the increase (or decrease) in value of mineral reserves and/or resources in tables. It must suffice to indicate that reserves of most commodities were increased sufficiently to provide for planned production for the next several years, and that during 1969, no rapid expansion in demand for any major commodity threatened the reserve-production ratio for the immediate future sufficiently to cause any major dislocations or adjustments in industry patterns. Nonetheless, from a more long-range viewpoint, economic reserves (as opposed to total resources, recoverable at any price) of certain commodities were only questionably adequate considering the continued growth of demand, and research efforts continued to be aimed at solving such problems, either through substitution for shortage commodities or through improvements in mining and recovery technology to lower production costs on marginal resources.

Efforts continued to be directed at the general world problem of stimulating economic growth in less developed countries in 1969. Some of these efforts involved mineral industries directly or indirectly. United Nations agencies and other multinational groups continued to conduct a number of programs of mineral resource exploration in the world's less developed areas, under either long-term low-interest loans or outright grants to the less developed countries concerned. Moreover, there were a number of similar arrangements of a bilateral nature between a single developed country and a single undeveloped country; for example, the U.S. Agency of International Development (AID) programs for nonferrous metals and phosphate minerals in India.

While multinational assistance programs have generally been restricted to resource investigations, in a number of cases bilat-

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eral arrangements have been extended to processing phases of the mineral industry.

Another form of assistance to the less developed countries has been in the form of preferential tariff arrangements such as those afforded to the African and Latin American Associate Member states of the EEC by the six full-member states. Such a scheme, involving the United States and less developed countries of Latin America and possibly other areas as well, was under study during 1969, and any such scheme, if adopted, presumably will apply to at least some mineral commodities.

PRODUCTION

The value of world crude mineral production in 1969 was estimated at roughly $87,000 million, an increase of about $3,000 million over the 1968 level.[2] As in previous years, comprehensive, statistically consistent data on the value added by processing of these materials in mineral industry plants in the various nations are wholly lacking, and can be estimated only very roughly; presumably the value added was $218,000 million or more.

PRODUCTION INDEX PATTERNS

United Nations production indexes for various sectors of the world's mineral industry (excluding that of Communist Asia) and for major groups of countries are presented in table 1. This series, using 1963 performance as the base point, indicates that, while all phases of the mineral industry registered gains in 1969 compared with their 1968 performance, all crude extractive sectors fell short of the growth rate for all industrial production. Among the mineral-processing sectors, base metal processing registered a greater increase than did total industrial production, but this gain was from a lower starting point and the 1969 index for base metal processing fell just short of that for overall industrial production. The nonmetallic mineral processing sector registered production gains that enabled it to remain on a par with overall industrial production gains, while the coal, petroleum, and chemical industry production index, which increased markedly in 1968 and for that year stood considerably above the general industrial production index, again in 1969 registered a significant gain, placing this industry sector once again in the forefront of the various sectors of industry that comprise the world's total industrial operations.

Examining the extractive mineral industry by its major component sectors—metal, coal, and petroleum (including natural gas)—the pattern of growth of each varied considerably, while contributing to a general rise in the index for the overall extractive industry in the first half of 1969, a slight decline in the third quarter, and a rise to new highs in the fourth quarter. Metal mining started the year with an index on a par with that of the total extractive industry and 1 point above that registered for the fourth quarter of 1968, advanced more sharply than the total extractive industry in the second quarter into the third quarter, and registered a decline in the fourth quarter. Coal mining showed a slight gain in the first quarter over its performance in the fourth quarter of 1968, then declined through the second and third quarters and again increased in the fourth quarter, following the traditional pattern of poor results during the Northern Hemisphere summer months. Petroleum and natural gas extraction showed a slight gain over fourth quarter 1968 results in the first quarter of 1969, moved significantly upward in the second quarter, registered a slight third quarter decline, and advanced sharply again in the fourth quarter; the bulk of the overall increase was attributable on a regional basis to consistent increases in performance of the industry in the Near East. In contrast to pattern of geographic distribution of overall extractive industry growth in past years, the Nations of Communist Europe (excluding Yugoslavia) recorded no substantial gains comparing total year results for 1969 with those for 1968—the overall

[2] Estimates based on extrapolation of data for 1963 compiled for and published in Annales des Mines, No. 4, 1966, pp. 7–98, to which has been added a factor equal to 11 percent of the total reported in that publication to allow for commodities not included in the Annales des Mines study. Extrapolation is based on United Nations indexes of extractive mineral industry production presented in table 1 of this chapter, but allows for production by countries not covered by the United Nations index. On this basis, figures for previous years, in thousand million U.S. dollars, follows: 1964, 69; 1965, 72 (revised from 1968 edition of this chapter); 1966, 76; 1967, 79; 1968, 84.

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index for extractive industry production for these Nations for 1969 stood only 3 points higher than in 1968, or 44 percent above that of 1963. The non-Communist world registered a 6-point gain to 130 percent of its 1963 performance; this was chiefly the result of gains registered by the less industrialized countries of Asia including the oil countries of the Near East.

Considering the mineral processing industry sectors in terms of their performance during 1969, world base metals enterprises showed a sharp growth comparing the first quarter of the year with the last quarter of 1968, edged upward slightly in the second quarter, declined in the third quarter, and registered new highs in the fourth quarter; the latter contributed significantly to an overall gain of all points in the annual average index compared with that of 1968. Nonmetallic mineral processing operations had a relatively poor first quarter, falling 6 points below their fourth quarter 1968 level of 143 percent of 1963 activity, but recovered sharply (15 points) in the second quarter, maintained operations at the second quarter level through the third quarter, and edged upward in the fourth quarter to a new quarterly high. In the case of the petroleum and coal processing and chemical industry, growth was fairly steady through the year, except for a very slight decline in the third quarter.

On a regional basis, the Communist countries of Europe showed greater growth in processing industry operations than they did in the extractive industries, and for another year showed greater gains relative to their 1963 performance than did the world's non-Communist countries. However, it should be stressed that these gains are solely relative to performance of the industries of these two areas in 1963, and the reader should consider the relative performance of these two areas in terms of quantitative output, for the gains of the Communist nations are from a lower base level in terms of quantitative output of most commodities.

QUANTITATIVE COMMODITY OUTPUT

Table 2 summarizes total world output of a number of mineral commodities for 1967–69, while table 3 gives the regional distribution of 1969 output of these commodities in terms of percent of world total. Tables within the statistical summary section of this chapter provide details on distribution of output of selected major commodities by major producers for 1967–69.

Nonfuel Mineral Commodities.—Of the 37 metallic mineral commodities listed in table 2, 30 registered increases in production in 1969 compared with 1968 results; declines were recorded, for the remaining seven. While the 1969 data are in general preliminary, and subject to revision, examination of detailed data for the producing countries indicates that in all likelihood these declines are actual and will not be eradicated by inclusion of additional, as yet unreported, tonnages. The most significant declines were those recorded for white arsenic (down 18.3 percent) and primary smelter tin (down 2.7 percent); other declines were by less than 2 percent. The most significant increases on a percentage basis alone were those registered for beryl, mine copper, ilmenite, and smelter zinc, all of which were up over 9 percent compared with 1968 performance. From the viewpoint of tonnage increases, gains in iron ore, pig iron, and steel ingots and castings were overwhelmingly dominant, followed by those registered for bauxite, alumina, and aluminum.

Among the 23 industrial nonmetallic mineral commodities for which world output data are listed in table 2, 16 showed a higher production level in 1969 than in 1968, while six registered declines. The 14.6-percent shortfall in graphite production was the greatest from a percentage viewpoint, but this was far overshadowed from the viewpoint of tonnage by the declines registered for phosphate rock (2.5 percent, 2.1 million tons), pyrite (1.6 percent, 356,000 tons), and native sulfur (2.0 percent, 241,000 tons). It should be noted that the decline registered for pyrite is in part due to exclusion of the U.S. figure for 1969, which was withheld to avoid disclosure of individual company data. Also noteworthy on a quantitative basis was the 931,000-carat decline (3.1 percent) in industrial diamond output. Among nonmetallic mineral commodities registering significant percentage gains in production in 1969 were nitrogen content of nitrogenous fertilizers (up 9.7 percent), gem diamond (up 8 percent), magnesite (up 7.8 percent), fluorspar (up 6.7 percent), and salt

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(up 6 percent). On a tonnage basis the 26.5-million-ton increases in cement output, the 7.6-million-ton upturn in salt production, and the 2.5-million-ton growth in nitrogen fertilizer (nitrogen content) were most prominent.

Tables 27 to 40 in the statistical summary section of this chapter give details of output of major nonfuel mineral commodities (both metals and nonmetals) by major producers in 1967–69.

Mineral Fuel Commodities.—Preliminary data indicate that world production of energy commodities in 1969 reached a new high in terms of standard coal equivalent (SCE), as output of all major crude mineral fuels reached new production highs. World output of commercial energy commodities [3] was about 6,518 million metric tons SCE, compared with 6,140 million metric tons in 1968 and 5,760 million metric tons in 1967. Each of the commercial energy sources listed in table 2 registered new record highs in 1969; previous record highs for all except coal had been the 1968 output levels, while the previous record high for coal production was in 1966. In 1969 for the third consecutive year, crude oil ranked as the leading source of energy on a percentage basis, and continued to increase its share of the total, as did natural gas; both gained at the expense of coal, while hydro-geothermal-nuclear power retained a consistent share of total as shown in the following tabulation:

Energy source	Share of total energy production (percent)		
	1967 [1]	1968 [1]	1969 [2]
Coal (including lignite)	38.3	37.0	35.7
Petroleum	40.4	41.4	42.1
Natural gas	19.0	19.4	20.0
Hydro, geothermal, and nuclear electricity	2.3	2.2	2.2
Total	100.0	100.0	100.0

[1] United Nations, World Energy Supplies 1965–68, Statistical Papers, Series J, No. 13, New York, 1970, p. 14.

[2] Estimate, based on extrapolation of United Nations data for 1968 using world production data for listed commodities reported to and published by the U.S. Bureau of Mines.

Among the energy products recorded in table 2, which include not only the primary energy sources but such processed items as coal and fuel briquets, available 1969 output data show gains for all commodities except anthracite coal and coke other than metallurgical.

Tables 41, 42, and 43, respectively, give output of coal, crude oil, and natural gas for 1967–69 by major producers.

TRADE

GENERAL TRENDS

The aggregate value of world mineral commodity trade in 1969 undoubtedly exceeded the estimated $63,230 million level attained in 1968, but data available at this writing was not sufficiently complete to estimate the 1969 level with any certainty. Despite the absence of complete 1969 trade data, it was apparent that during this year, as in 1968, the less industrialized nations continued to expand output of mineral commodities for processing in developed countries at a greater rate than the developing countries expanded internal production of such materials. The 1969 aggregate value of mineral commodities traded was increased over that of 1968 by increased shipments of these crude and partly processed mineral commodities from less developed nations to the developed countries for processing, and also by a greater flow of mineral semimanufactures from developed countries to those less industrialized nations, as their requirements for such materials increased. Moreover, overall value growth in mineral commodity trade was further expanded by generally higher prices for a number of commodities during 1969.

In 1968, the most recent year for which largely complete trade returns are available on a worldwide basis, mineral commodities in aggregate were estimated to have accounted for about 26.5 percent of total commodity trade, a somewhat larger share of the total than in 1966 or 1967, on a par with the 1964 level, but not as great a share as in 1965, as shown in the following tabulation:

[3] Excludes wood, charcoal, bagasse, animal dung, and other minor fuels, although such fuels are used as commercial fuels in some countries, and in a few Nations, account for a significant part of total energy material production.

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Year	Estimated value of all mineral commodities traded [1] (million dollars)	Increase relative to previous year (percent)	Mineral commodities, share of all commodities traded (percent)
1964	r 45,620	r 13.3	26.5
1965	r 49,870	r 9.3	26.8
1966	r 53,060	r 6.4	26.1
1967	r 56,540	r 6.6	26.4
1968	63,230	11.8	26.5

r Revised.
[1] Value estimated from data on major mineral commodities appearing in table 4, to which has been added a factor for mineral commodities not included in that table. The factor added is based on comparison of complete mineral trade value returns for selected countries with data given for these same countries in the source for table 4, which includes only the selected mineral commodity groups specified in the footnotes to that table. This comparison indicates that the recorded mineral commodities listed in table 4 represent about 81.5 percent of total mineral commodity trade.

The tabulation also indicates that in reaching the new record high total value of $63,230 million, mineral commodities registered an 11.8-percent gain over 1967, the greatest percentage increase recorded since 1964.

COMMODITY GROUP TRADE PATTERNS

Table 4 gives the value of world export trade in major mineral commodity groups for 1964–68 and provides for comparative purposes the value of total world commodity exports. Although major mineral commodities in 1968 accounted for only a slightly larger share of total world commodity trade than in recent past years, and although each of the major groups of mineral commodities has shown virtually unbroken growth trends during 1964–68, there have been significant variations in the proportion of total major mineral commodity trade accounted for by each of the principal groups of these commodities, as shown in table 5. These variations are the result of the different growth rates registered by the several commodity groups lised. These growth rates are given in table 6. The most pronounced trend has been the declining proportion of total major mineral commodity trade accounted for by ores, concentrates, and scrap in every year in the period 1964–68. In contrast, nonferrous metals generally registered gains in each year during this period, except for a modest slump in 1967 that was virtually canceled out by a recovery in 1968 nearly to the 1966 share level. Iron and steel and nonmetals have generally shown percentage declines in recent years, the former since 1965, the latter since 1966, while mineral fuels have fluctuated—down in their share between 1964 and 1966, then up in 1967 and down again in 1968.

Table 6 also reflects the general upturn in the value of export trade in each of the major mineral commodity groups. Within the 5-year span covered by the table, only in the case of iron and steel in 1966 was there a decline relative to the previous year's level, and this was only a fraction of 1 percent. Comparing the growth rates recorded for the aggregate of the five individual major mineral commodity groups listed with that of overall commodity export trade for the 5 years shown, the major mineral commodity groups showed a somewhat greater overall growth in every year except 1966.

REGIONAL TRADE PATTERNS

Data on the geographic distribution of world trade in major mineral commodities (metal ores, concentrates, and scrap, ingots and semimanufactures of iron and steel and of nonferrous metals, crude nonmetals,[4] and all mineral fuels) are presented in terms of dollar value in tables 7, 8, and 9 for 1968, the most recent year for which reasonably comprehensive data are available. Table 7 is designed to show the importance of total major mineral commodity export trade relative to total commodity export trade for the world as a whole and for selected individual countries and country groups. Table 8 gives the breakdown by commodity groups of total major mineral commodity trade, in terms both of ex-

[4] Crude nonmetals were not included in this group in previous editions of this chapter; thus data on trade in major mineral commodities in this edition are not comparable with those presented in previous editions.

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ports from and exports to each of these selected countries and country groups, reflecting to some extent regional self-sufficiency or the lack thereof for each commodity group. Table 9 shows the direction of flow of total value of major mineral commodity trade by selected countries and areas.

The following tabulation gives the distribution of world trade in major mineral commodities between industrialized nations and less developed countries for 1968:

Destinations	Sources of exports		
	Industralized countries	Less developed countries	Total
Value in million dollars:			
To industrialized countries	25,566	17,846	43,412
To less developed countries	4,725	3,403	8,128
Total	30,291	21,249	51,540
Share of world total in percent:			
To industrialized countries	49.6	34.6	84.2
To less developed countries	9.2	6.6	15.8
Total	58.8	41.2	100.0

The data presented in the foregoing tabulation are not exactly comparable to those published in the 1968 edition of this chapter, owing to the inclusion in this year's chapter of data on crude nonmetals exports. Nonetheless, available information indicates that in 1968, the industrialized nations provided a larger share of total major mineral commodity exports than in 1967; this reversed a trend extending back to at least 1965, under which these nations accounted for a steadily decreasing share of the export total, while the less developed countries had been providing an increasing share of the total. However, the longstanding pattern of industrialized nations receiving as imports an increasing share of the total world major mineral commodity exports seemingly remained unaltered.

Considering the contents of table 7, it is significant to note the wide variation between regions in the share of total regional commodity exports accounted for by the major mineral commodities. The Near East, largely as a result of the huge oil exports, ranks highest with 83.8 percent of the total, followed by those nations classified as "rest of world" with 56.4 percent, nonindustrialized Africa (Africa except the Republic of South Africa) with 48.6 percent, and Latin America with 39.1 percent. At the other end of the spectrum are the United States, with only 9.4 percent, and Communist Asia with 6.9 percent. It should be noted that from the figures presented in the table, the Republic of South Africa ranks very low, with only 5.2 percent, but this figure is based solely on the nation's fuel exports; the sizable sums for gold, diamond, and a number of other key mineral commodities are not included in the mineral total owing to absence of such data in the source publication.

Considering these exports from the viewpoint of the indicated recipients, the variation in terms of percent of total commodity export trade accounted for by major mineral commodities is not nearly as wide as the variation from the viewpoint of origin for most countries and areas listed. Japan ranks far ahead of other listed regions, with major mineral commodities accounting for 40.5 percent of the total. In the case of most other highly industrialized countries, major mineral commodity imports fall within the range of 20 to 25 percent of total commodity trade; Canada, the Republic of South Africa, and Australia-New Zealand are the most prominent exceptions. These nations, with low population densities and sizable undeveloped mineral resources, follow more the import pattern of the less developed areas, with major mineral commodities accounting for only 12 to 15 percent of total commodities listed as exported to them. Among the specifically identified less developed areas, only Communist Asia received export shipments of major mineral commodities in quantities sufficient for the total value to reach a level in excess of 20 percent of the total of all commodity shipments to the area.

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Table 8 requires little explanation except to note the principal exclusions—the absence of data for metal and crude nonmetal exports (most notably gold and diamond, in terms of value) from the Republic of South Africa, and of all crude nonmetal data for Latin America, the Near East, South Asia, the Far East, Australia, and New Zealand. While a portion of these figures are apparently included under "not reported," and thus apparently do swell the world total to an appropriate level, the importance of these commodities to the specific countries cannot be shown. Moreover, owing to the scheme of reporting used (Standard International Trade Classification, Revised—SITC), gold is excluded from all totals.

Table 9, generally speaking, requires no detailed explanation or discussion except to note that data contained therein are not exactly comparable to those in the outwardly similar tables appearing in previous editions of this chapter, because an additional commodity group—crude nonmetals—has been included in the 1969 edition.

As in past years, the countries of the EEC in 1968 provided slightly over 20 percent of total world exports of major mineral commodity exports and received over 28 percent of these shipments on a value basis. In terms of export price valuation, the EEC countries had a negative major mineral commodity trade balance of $4,465 million. Of the total value of major mineral commodity export trade credited to the EEC, $5,375 million was for commodities traded between the member nations, while exports to non-EEC countries were valued at $5,070 million and exports from non-EEC nations to the EEC countries were valued at $9,535 million.

The member states of the EFTA in 1968 provided 7.4 percent of all major mineral commodity exports on a value basis and were the reported destination for 10.7 percent of world exports of these materials on a value basis. The region recorded a total deficit of $3,710 million in net trade on an export price basis for major mineral commodity groups in 1968.

The Communist nations of Europe (excluding Yugoslavia) in 1968 recorded exports of major mineral commodities with a value equal to 11.3 percent of total world exports of these commodities, while these nations collectively received major mineral commodities with a value equal to 8.5 percent of total world exports of these materials. The European Communist countries thus registered a positive trade balance of $1,435 million, an increase of $180 million over the 1967 level.

While the greater part of the total major mineral commodity trade of these nations in 1968 continued to be with other nations of the group, the percentage of this total accounted for by intratrade diminished markedly. Of total major mineral commodity exports credited to the nations of this group in 1968, 52 percent by value was destined for other Communist European countries, compared with 60 percent (of the smaller total) in 1967. Considering world major mineral commodity shipments by their reported destinations, almost 70 percent of the total destined for Communist European countries originated in other Communist European countries in 1968, compared with almost 80 percent in 1967.

Recorded major mineral commodity exports of Communist Europe to other nations increased by $750 million to $2,770 million from 1967 to 1968, while exports of other nations to this group increased by $570 million to $1,335 million. While the figures cited for 1967 are not strictly comparable to those for 1968 owing to the inclusion in the latter figure of data for crude nonmetals, the addition of this commodity group accounts for only a modest part of the increase in trade with other nations.

Japan, separated from other Asian nations owing to its position as the only major industrialized nation of the area, was the indicated destination for 8.6 percent of total world exports of major mineral commodities and was the source of 3.7 percent of these exports. Japan's major mineral commodity exports increased by $493 million in 1968 relative to the 1967 level [5] for an increase of 35 percent, compared with the 2.4-percent decline in 1967 relative to 1966 performance. Considering exports to Japan, the 1968 level was $460 million greater than in 1967, an increase

[5] Inasmuch as Japanese export data presented here for 1968 exclude crude nonmetals, they are directly comparable to 1967 figures. Data on major mineral commodity exports of other nations to Japan do include figures for crude nonmetals, but these commodities account for only $110 million of the total reported.

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of less than 12 percent compared with the 43-percent growth recorded between 1966 and 1967. Thus the nation's negative trade balance in major mineral commodities stood at $2,524 million for 1968, down slightly from the $2,557 million level of 1967 but still far above the $1,328 million level of 1966.

Considering the remaining industrialized areas of the world—the United States, Canada, The Republic of South Africa, Australia, New Zealand, and the nations of non-Communist Europe that are not members of EEC or of EFTA taken as a group —all showed gains in dollar value of major mineral commodity exports to other nations in 1968 relative to those of 1967, and the gains recorded were substantially greater than the value of the crude nonmetals exports that were included for the first time in 1968 in the detail in table 9.

Examining these same countries from the viewpoint of the reported value of exports to them, all showed increases in 1968 relative to 1967 (again discounting the effect of the addition of crude nonmetals shipments to the 1968 figure) except for the Republic of South Africa.

Comparison of the share of total world major mineral commodity exports accounted for by these nations in 1968 with the 1967 results given in previous editions of this table would not be valid, owing to the inclusion of crude nonmetals in this edition.

Considering the world's less developed countries in groups on a continental basis, all showed increases in dollar value of both exports to and exports from the areas in question except for Communist Asia, which registered a decline in the value of exports to other areas (again discounting the increase resulting from the inclusion of crude nonmetals in 1968).

CONSUMPTION

NONFUEL MINERAL COMMODITIES

World consumption of most nonfuel mineral commodities, both metals and nonmetals, again advanced in 1969 both in terms of gross tonnage and on a per capita basis, but the latter gains were more modest and less universally consistent as world population continued to increase. Considering individual major commodities, world consumption of iron ore apparently reached a record high. Complete data on iron ore consumption for 1969 were not available at this writing; however, for a selected group of 21 nations, including all major world producers of pig iron except mainland China, iron ore consumption in agglomerating plants, blast furnaces, and steelmaking totaled about 579 million tons (total includes some estimates), a figure nearly 7 percent greater than the level recorded for the same nations in 1968, as indicated in table 10. Of total iron ore consumption, over half is treated in agglomerating plants prior to being fed to the blast furnace; a relatively small part of the total (about 8 million to 9 million tons annually)—is consumed directly in steelmaking and the balance, with or without agglomeration, is fed to blast furnaces and other facilities for the production of pig iron and similar products.

As in the case of iron ore, complete world data for consumption of iron and steel scrap are not available, but for the same 21 countries listed in table 10, 1969 recorded scrap consumption totaled about 252 million tons, compared with 236 million tons in 1968 and nearly 234 million tons in 1967. It should be noted that these scrap consumption figures are incomplete in that use in a number of types of facilities other than blast furnaces and steelworks is not reported for many countries; thus actual total scrap consumption in the 21 nations listed undoubtedly exceeded the foregoing recorded totals.

World consumption of iron and steel, while not recorded, undoubtedly reached a new record, in keeping with production growth.

In the case of major nonferrous metals, for which estimated world consumption data appear in table 11, world use of each of the five metals shown reached new highs in 1969. In terms both of growth rate and tonnage increase, aluminum headed the list with a 10-percent, 890,000-metric-ton increase to 8,984,000 tons. The percentage growth was slightly lower than the 11.9 percent recorded for 1968, but on a tonnage basis, the annual increase exceeded that of 1968 as well as the previous record high for tonnage increases—that of

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630,400 tons recorded between 1958 and 1959. An increase of 8.6 percent was registered for world copper consumption; on a tonnage basis, the increase amounted to 553,000 metric tons, for a new high of 6,989,000 tons. Lead consumption reached nearly 3.5 million metric tons, 9.2 percent above the 1968 level, while zinc consumption rose only 5.7 percent to about 4.6 million tons. Tin consumption, with a 4-percent growth to 181,000 long tons, increased more significantly than in 1968, but still ranked far behind the other major nonferrous metals in terms of percentage growth.

While complete world data on nonmetallic mineral consumption are not available, it is certain that use of most major commodities—limestone, cement, sulfur, and fertilizer materials—advanced in 1969. World consumption of nitrogen fertilizers for the fertilizer year 1968–69 (year ending June 30, 1969) was reported [6] to have totaled 26,765,000 tons in terms of nitrogen content, more than 2.4 million tons over the level for the preceding fertilizer year. This increase for nitrogen fertilizers, however, was apparently diametrically opposed to the trend for consumption of phosphate rock and crude potash as inferred by production levels for these fertilizer raw materials, which registered output declines for the first time in several years. (Consumption data for phosphate rock and crude potash are not available).

MINERAL FUEL COMMODITIES

Total world consumption of traditional commercial mineral fuels (coal, oil, and natural gas) and of primary electric power generated by means other than the burning of these fuels) in terms of SCE in 1969 was estimated to be about 6,400 million metric tons, but final returns may alter this figure appreciably. In 1968, the latest year for which reasonably complete returns are available, total energy consumption from the aforementioned sources reached 6,016 million metric tons, over 7 percent greater than the 1967 level. Table 12 details energy consumption by major source (solid fuels, liquid fuels, natural gas, primary electric power) and by continental areas for 1964–68, as reported by the Statistical Office of the United Nations. On the basis of data in this table, liquid fuels were the leading energy source for the second consecutive year, accounting for 40.0 percent of total consumption (39.5 percent in 1967), followed by solid fuels with 38.0 percent of the 1968 total (38.8 percent in 1967). Gaseous hydrocarbons accounted for 19.7 percent of the 1968 total (19.4 percent in 1967), while primary electric power roughly held its own, accounting for about 2.3 percent in both 1968 and 1967. Thus, liquid and gaseous fuels both recorded substantial gains on a quantitative basis and in doing so registered growth rates in excess of that recorded for solid fuels; this further eroded the position of solid fuels on a percentage basis. Growth rates for each of the categories for 1967–68 were as follows: Solid fuels, 4.9 percent; liquid fuels, 8.7 percent; gaseous fuels, 8.9 percent; primary electric power, 5.3 percent.

While data for 1969 are not sufficiently complete to determine growth rates by each class of fuel or the share of each of total consumption, it appears certain that the solid fuel growth rate did not equal that of total energy, and that the solid fuel share was further eroded in 1969, with liquid fuels and gaseous fuels gaining more rapidly and thereby increasing their share of the total.

The sharp recovery in solid fuel consumption in 1968 after the 1967 slump was chiefly the result of a restoration of coal production and industrial activity in coal-consuming industries in mainland China following the major political disorders and associated interruption in both production and consumption of energy in that area in 1967. The notable growth in liquid fuel use in 1968 was attributed to successful efforts on the part of suppliers to overcome delivery obstacles arising in 1967 as a result of hostilities in the Near East. While the continuing instability of this region and the potential effect of this instability on oil deliveries remained effective forces in partially retarding the slump of solid fuels in the West European energy market, use of these materials nonetheless continued to edge downward.

Examining the data in table 12 from a regional viewpoint, the distribution of total 1968 energy consumption varied only slightly from that of 1967, despite some rather significant differences in regional growth rates, owing to the overwhelming

[6] Nitrogen (London). No. 63 January–February 1970, pp. 13–14.

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dominance of three main areas—North America, Western Europe, and Communist Europe-Asia (the latter being the dominant element in the group of unspecified countries). South America (the dominant part of "Other America" in the table), the Far East (led by Japan), and Communist Europe-Asia recorded gains in excess of the world total and thus accounted for a slightly larger share of the total. Caribbean America and the Near East were quite close to the world total growth rate. North America, Western Europe, and Oceania failed to register growth rates equaling that of the world total, thereby accounting for slightly lower shares of the total. No area, however, recorded a change in share of the total of more than a few tenths of a percent.

From the viewpoint of per capita consumption, each of the world areas listed showed an increase, but as in the past, the developed nations of North America and Europe registered the most significant increases—several hundred kilograms per person—despite their lower growth rates on the basis of total tonnage consumed, while the less developed nations recorded only modest per capita gains—a few tens of kilograms in each area. It is perhaps significant that the declines in per capita consumption noted in Africa and "countries not elsewhere specified" between 1966 and 1967 were reversed in 1968—in both cases the 1968 figure reached a new high. The 1967 decline in unspecified countries as noted previously was primarily due to the precipitous decline in consumption by mainland China. This area, while showing an increase in 1968 relative to the 1967 figure, failed to reach its 1966 peak in 1968.

INVESTMENT

Comprehensive data on world investment in mineral industry operations are not available, but partial data on investment in certain geographic areas and certain major commodity sectors of the total industry may illustrate the continued overall growth in such investments.

Table 13 summarizes steel industry investment expenditures for countries and country groups within the Organization for Economic Cooperation and Development (OECD). The reported data indicate an increase of 6.3 percent in the level of annual investments for 1969 over 1968 levels for the listed countries, a figure lower than the 10.5-percent growth between 1967 and 1968, and the 9.2-percent growth between 1966 and 1967. These steel industry investments continued to result in increases in productive capacity, but these increases have come about chiefly through the replacement of old equipment with facilities capable of producing greater quantities of steel at lower unit costs, rather than by simply adding additional facilities. Additional oxygen steel process equipment and sintering and pelletizing plants for iron ore processing again represented significant parts of the total investment, not only among OECD countries, but also in other steel-producing nations and iron ore source nations.

Table 14 summarizes non-Communist world petroleum industry capital expenditures and exploration expenses for 1966–69, distributing the totals on a geographic basis. In 1969, overall capital expenditures and exploration expenses were increased only 2.7 percent over the 1968 level, a far smaller increase than the 14.7 percent growth registered between 1967 and 1968 and less than half as large as the 6.2 percent registered between 1966 and 1967. The 1968 to 1969 growth was not distributed uniformly between continental areas, with expenditures in the United States and Western Europe standing at lower levels than in 1968 and the growth registered for other areas varying from a high of 15.6 percent in the Near East to 6.6 percent for the Far East, with the unspecified area figure increasing only 3.8 percent.

Overall expenditures and expenses in the United States decreased 1.8 percent; thus that area, while retaining a commanding lead over all others in terms of total value, accounted for only 45.0 percent of the 1969 total compared with 47.2 percent in 1968, and 49.3 percent in 1967 and 1966. In Western Europe, total expenditures and expenses in 1968 were almost 5.3 percent below those of 1968; the region accounted for only 13.2 percent of the total (14.3

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percent in 1968, 16.9 percent in 1967, and 16.3 percent in 1966), and it remained in second-ranked status as the locale for capital expenditures and exploration expenses among the areas listed for the second year.

"Other western hemisphere" (Canada and Latin America) registered an 8.3-percent increase over the 1968 level, accounting for 15.1 percent of the total (14.3 percent in 1968, and 12.6 percent in 1967, and 1966), and continued to increase its lead over Western Europe in terms of dollar value. Africa accounted for expenditures and expenses 5.9 percent greater in 1969 than in 1968 and thus took 4.6 percent of the non-Communist world total (4.5 percent in 1968). In the Far East expenditures and expenses in 1968 were 6.6 percent greater in 1969 than in 1968, and represented 8.2 percent of the total (7.9 percent in 1968). This increase was chiefly the result of plant construction in Japan. The Near East, registering a 15.6 percent gain in value, accounted for 3.9 percent of the 1969 total compared with 3.5 percent in 1968 and 3.6 percent in 1967. Regionally unallocated capital expenditures, chiefly tanker construction, advanced only 3.8 percent in 1969, compared with 31.7 percent in 1968, and comprised 9.9 percent of the total (8.3 percent in 1968).

Table 15 distributes the same totals of non-Communist world capital expenditures and exploration expenses for 1966–69 by industrial sectors. Here too, there were significant shifts in the pattern of distribution, comparing that of 1969 with those of 1968. Capital expenditures relating to production facilities increased by 1.7 percent and constituted 38.2 percent of the 1969 total (38.8 percent in 1968), while such expenditures for pipelines decreased by 15.6 percent in 1969 relative to the 1968 level, accounting for 4.6 percent of total expenditures and expenses (5.6 percent in 1968).

Expenditures for marine facilities in 1969 showed the most marked growth, increasing 24.8 percent over those of 1968, with the result that they represented 10.6 percent of the total (8.7 percent in 1968). Other categories registering a higher share of the total in 1969 than in 1968 were refining—up 8.8 percent to 16.2 percent of the total (15.3 percent of the 1969 total); marketing up 5.3 percent to 14.2 percent of the total (13.9 percent of the 1968 total); and exploration expenses, up 3.8 percent, to account for 7.0 percent of the total (6.9 percent of the 1968 total).

In the case of expenditures for chemical plants, the total decreased by 11.5 percent, and this category accounted for only 6.6 percent of the total (7.7 percent in 1968). Expenditures for miscellaneous items declined even more sharply, falling 13.6 percent below 1968 levels, with the result that its share of the total was only 2.6 percent.

Table 16 details U.S. direct investment in mining, smelting, and refining and in petroleum industry activities in foreign areas for 1968 and 1969. The overall growth rate of this foreign investment in mining and smelting between 1968 and 1969 was 3.7 percent, a markedly lower figure than the 13.0-percent increase between 1967 and 1968 and the 11.5-percent increase registered between 1966 and 1967. In the case of petroleum investment, too, the increase between 1968 and 1969 was at a new low for recent years—5.8 percent compared with 8.5 percent between 1967 and 1968 and 7.4 percent between 1966 and 1967. Examining U.S. investment on regional basis, it is significant that between 1968 and 1969 mining and smelting investment declined in Latin America and Europe, while increasing in other listed areas, while in the case of petroleum investment, all areas shared in the increase except the Near East, where a very slight decline was noted.

TRANSPORTATION

MARINE TRANSPORT

Three major classes of vessels are engaged in transporting mineral commodities —oil tankers, bulk carriers, and freighters. Table 17, derived from a report of the U.S. Maritime Commission, summarizes the world's total merchant fleet in terms of number of vessels and tonnage, listing these classes separately. In the case of each of these major classes, not all of the vessels listed are engaged in transporting mineral commodities. Tankers, although unquestionably most heavily devoted to trade in crude oil and refinery products, move some chemicals and other materials such as

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whale oil. Bulk carriers heavily engaged in movement of metal ores, cement, and fertilizers move bulk agricultural products in addition to mineral commodities. Freighters, in contrast to tankers and bulk carriers, are not primarily engaged in mineral commodity shipment, but nonetheless, these vessels move sizable quantities of metal ingots and semimanufactures, and although the volume of crude mineral material is not large, are also engaged in ore and concentrate movement. While data are not available on a worldwide basis on tonnage of mineral commodities moved as a percent of tonnage of all commodities, moved, it is significant that in fiscal 1969, 62 percent by weight of all goods transiting the Panama Canal were mineral commodities. It may be inferred that, of the world total, an even higher proportion may be accounted for by minerals, since many of the new large tankers and bulk carriers, which account for a significant share of total tonnage or commodities moved, are excluded from using the Canal by their size.

From the data in table 17, the world merchant fleet[7] at yearend 1969 totaled 19,570 vessels with a gross tonnage of 196,247,000 tons and a deadweight tonnage of 297,523,000 tons, increases of 1.1 percent, 6.5 percent, and 8.9 percent, respectively, over the yearend 1968 totals. The percentage increases registered for the total merchant fleet during 1969 were less than those logged in 1968 for number of vessels (3.0 percent), gross tonnage (7.4 percent), and deadweight tonnage (9.1 percent), and only in the case of deadweight tonnage was the increase in 1969 quantitatively greater than in 1968. Total merchant fleet growth in 1969 was not consistent, however, between the various classes of vessels. Tankers and bulk carriers registered gains in both number and tonnage; freighters declined in numbers and showed slight increases in tonnages; other vessels (passenger-cargo, passenger-refrigerated cargo, and refrigerated freighters) registered declines in both tonnage and numbers. The world merchant fleet by vessel type continued to shift in 1969, with tankers and bulk carriers accounting for an increased share both in numbers and in tonnage, and freighters and other ships accounting for a decreased share.

Tankers.—Expansion of the world tanker fleet continued to be faster than that of the total world merchant fleet, and expansion in 1969 exceeded that registered in 1968 both quantitatively and on a percentage basis. Between yearend 1968 and 1969, the total tanker fleet increased by 4.5 percent in number of vessels, 10.9 percent in gross tonnage, and 13.9 percent in deadweight tonnage; comparable figures for the previous corresponding period were 4.1 percent, 8.9 percent, and 11 percent, respectively.

The average gross tonnage of tankers in service increased from 18,393 tons in 1968 to 19,518 tons in 1969; in terms of deadweight tonnage the increase was from 30,073 tons to 32,774 tons, reflecting additions to the fleet of tankers of greater size than those taken out of service. By way of comparison, in 1966, the average gross tonnage was only 16,343 tons, while the average deadweight tonnage was 25,768 tons. The shift toward larger tankers is more dramatic when examined in detail by various size groups, and is particularly pronounced when data for existing vessels are compared with those for planned new construction. Table 18, compiled from a source other than the U.S. Maritime Commission and differing slightly in totals from those given elsewhere in this section, indicates that of the world's total 1969 tanker fleet of about 135 million deadweight tons, 19.9 percent was in tankers of 105,000 deadweight tons or more each, compared with only 11.3 percent in 1968 and only 3.6 percent in 1966. Assuming that all additions underway and on order at yearend 1969 are completed and in service by yearend 1969, and discounting reductions in total deadweight tonnage owing to losses, scrapping, and other deletions from the roster of vessels in service at yearend 1969, 69.5 percent of the 1971 total in deadweight tonnage will be in ships of over 105,000 deadweight tons each, including 30.9 percent in vessels of over 205,000 tons each and 38.6 percent in vessels of 105,000 to 205,000 tons each.

The rapid changeover in the world tanker fleet continued in 1969 and is reflected in breakdown of the total tonnage of these vessels by age groups. The following tabulation compares the 1969 distribu-

[7] Oceangoing steam and motor ships of 1,000 gross tons and over.

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tion of total tonnage by age groups with that recorded for 1968:

Year of completion	Percent of total tonnage	
	1968	1969
Up to yearend 1945	5.4	4.5
1946-50	2.7	2.1
1951-55	12.9	11.1
1956-60	24.4	21.6
1961-65	29.2	26.0
1966-69	25.3	34.6

Source: British Petroleum Co. Ltd. BP Statistical Review of the World Oil Industry—1969. Bayard Press, London, 1970, p. 14.

Distribution of the world tanker fleet at yearend 1969 by flag of registry, ranked in order of national aggregate deadweight tonnage, was as follows:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Liberia	696	30,889
United Kingdom	423	17,314
Norway	377	16,215
Japan	359	14,128
United States	305	7,594
Panama	170	5,555
France	142	5,242
Greece	179	5,201
U.S.S.R.	353	4,743
Italy	182	3,911
Netherlands	92	3,103
Sweden	76	2,731
Denmark	56	2,474
Spain	102	2,251
West Germany	50	2,236
Other	509	9,834
Total	4,071	133,421

Bulk Carriers.—As in the case of tankers, world bulk carrier fleet growth between yearend 1968 and yearend 1969 exceeded the level of growth of the total merchant fleet for that period. The number of vessels increased 5.3 percent, while the gross tonnage advanced 11.0 percent and the deadweight tonnage recorded for the type of carrier moved upward by 12.9 percent. In the case of bulk carriers, however, growth in 1969 was at a markedly lower rate than in 1968, when increases of 10.2 percent for number of vessels, 18.8 percent for gross tonnage, and 20.7 percent for deadweight tonnage were recorded.

As noted previously, this class of vessel includes both those moving crude minerals and concentrates and those hauling bulk agricultural products. However, the continued significant growth is attributed chiefly to additions of large ore carriers and of large combination (ore-oil-other material) carriers. While Maritime Commission data do not distinguish mineral commodity-oriented bulk carriers from those engaged in agricultural trade, other sources indicate that at yearend 1968 the aggregate deadweight tonnage of combined ore-oil-other material carriers was 11 million tons, with 7 million deadweight tons of such vessels under construction; at yearend 1969, 13.6 million deadweight tons of such ships were reported under construction (no figure for completed vessels available).

As in the case of tankers, there has been a marked upturn in the average size of bulk carriers. At yearend 1966, such vessels had an average gross tonnage of 10,967 tons (16,762 deadweight tons), while at yearend 1969, the average gross tonnage was 15,191 tons (24,614 deadweight tons).

Almost 81 percent of the total 1969 world bulk carrier fleet in terms of number of vessels and over 87 percent of that fleet in terms of deadweight tonnage was registered under the flags of 12 nations as shown in the following tabulation, ranked in order of deadweight tonnage to each flag:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Liberia	516	16,427
Japan	385	11,008
Norway	332	10,202
United Kingdom	292	5,977
Greece	131	3,294
Italy	115	3,097
Sweden	87	2,643
West Germany	88	2,412
France	62	1,221
India	35	1,150
United States	48	941
U.S.S.R.	133	810
Other	524	8,456
Total	2,748	67,638

Freighters.—Freighters, which constituted 56 percent of the world's merchant fleet in terms of number of vessels at yearend 1969, accounted for only 32 percent of the aggregate gross tonnage and 29 percent of the aggregate deadweight tonnage of the total merchant fleet in that year. Compared with tankers and bulk carriers, a much smaller proportion of the total number of these vessels are engaged in moving mineral commodities; nonetheless mention of this class of ship is in order since they are the prime class of ocean carrier for processed mineral goods, particularly metal smelter and mill products. Unlike tankers and bulk carriers, the number of freighters

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in service at yearend 1969 actually declined relative to the yearend 1968 total, while the aggregate gross tonnage and deadweight tonnage accounted for by this class increased less than 1 percent.

While the trend toward gigantism noted for tankers and bulk carriers did not extend to freighters, there has been a modest increase in size in the average of such vessels, from 5,595 gross tons and 7,871 deadweight tons in 1966 to 5,734 gross tons and 7,946 deadweight tons in 1969.

Principal nations of registry of freighters are listed in the following tabulation in order of their share of aggregate deadweight tonnage of total world freighter fleet at yearend 1969:

Country	Number of vessels	Deadweight tonnage (thousand tons)
United States	1,359	14,585
Japan	1,157	9,160
United Kingdom	851	7,616
U.S.S.R.	999	6,374
Greece	701	5,735
West Germany	704	4,858
Liberia	455	4,535
Norway	443	3,417
Netherlands	281	2,494
Panama	347	2,222
India	182	1,795
Other	3,501	24,459
Total	10,980	87,250

PANAMA AND SUEZ CANALS

Despite the continued trend toward construction of oceangoing carriers for mineral commodities so large that they cannot be accommodated by the world's two major international seaway canals, these maritime shortcuts continued to have a marked influence upon marine mineral transport patterns through 1969. The Suez Canal's influence remained a negative one, since it was closed for the second entire year because of the prolonged hostilities between the United Arab Republic and Israel; the latter continued to occupy the Sinai Peninsula right to its east bank. This situation provided a continuing stimulus to the construction of supertankers (unable to navigate this waterway, even if it reopened) for the Persian Gulf-European oil trade. Such construction was aimed at reducing to a minimum possible level the cost of the far longer haulage route around the Cape of Good Hope. The experience of Suez Canal users during the past decade or more has clearly demonstrated the tenuous nature of this route, and the fact that even assuming the reopening of the waterway, its operation would be subject to interruption at any time.

In the case of the Panama Canal, official data of the Panama Canal Company on vessels transiting the waterway during fiscal 1969 indicate that of a total of 103 million metric tons of cargo passing through the canal in vessels classified as commercial ocean traffic, almost 62 percent consisted of mineral commodities, an increase of about 0.6 percent over the 1968 level, and 1.8 percent over the 1967 figure.[8] The fact that mineral commodities accounted for an increasing share of total goods transiting the Panama Canal is particularly significant in view of the previously mentioned trend toward construction of vessels too large to transit the canal, and when it is noted that the total quantity of goods transiting the canal has been increasing consistently despite such construction. The following tabulation summarizes Panama Canal activities for fiscal years 1967–69, in terms of number of transits and cargo moved, showing the importance of mineral commodities to the total:

[8] Data presented in the 1967 and 1968 editions of this chapter regarding quantity of mineral commodities moved through the Panama Canal and the percentage share of total materials moved accounted for by mineral commodities were in error, in that they were based on incomplete totals, both for minerals and for all cargo.

	Fiscal years		
	1967	1968	1969
Number of transits:			
Commercial ocean traffic	12,412	13,199	13,150
Other traffic	1,658	2,312	2,177
Total	14,070	15,511	15,327
Cargo moved (million metric tons):			
Commercial ocean traffic:			
Mineral commodities	52.7	60.2	63.9
Other commodities	34.9	37.9	39.1
Subtotal	87.6	98.1	103.0
Other traffic, all commodities	6.9	9.1	7.5
Total	94.5	107.2	110.5

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Details on the distribution of commercial ocean traffic transiting the canal by vessel type, by direction of movement (Atlantic to Pacific or Pacific to Atlantic), and by the status of the vessel (in ballast or laden) for 1968 and 1969 are given in table 19, together with the tonnage of cargo moved by each type. Table 20 lists movement of specific mineral commodities and commodity groups on a tonnage basis for 1967–69, also indicating direction of movement through the canal.

Of total Panama Canal traffic in mineral commodities in recent years, about three-quarters of the total has been from the Atlantic to the Pacific. Of this material, coal and coke and petroleum have been the dominant commodities; in 1969 coal and coke accounted for 34.2 percent of the total, and oil (crude and refined) for 33.6 percent. Of the one-quarter of total Panama Canal mineral commodity movement in the Pacific-Atlantic direction, steel semimanufactures have been the dominant commodity group, accounting for over 35 percent of the 1969 total.

In 1969, Pacific to Atlantic mineral commodity movement increased 6.5 percent on a tonnage basis over the 1968 level, chiefly as a result of the 31-percent increase—almost 1.3 million tons—in iron and steel semimanufacture shipments. This increase, together with those recorded for other commodity groups that were lesser on a tonnage basis if not in terms of percentage increase, more than compensated for declines registered for 15 of the 36 commodities and commodity groups for which data are presented in table 20. In comparison, Atlantic to Pacific mineral commodity movement increased 5.9 percent, chiefly because of a 3.2-million-ton, 23.7-percent increase in coal and coke shipments, an increase which was partly counter balanced by lower levels of mineral commodity shipments for 10 commodities and/or commodity groups.

OCEAN FREIGHT RATES

Table 21 presents United Nations indexes of selected ocean freight rates for 1966–69, including quarterly figures for 1968 and 1969. Without exception, annual averages in 1969 were lower than those recorded for both 1968 and 1967, but in most cases they were higher than the 1966 level.

PIPELINES

Although space limitations and unavailability of complete summaries of existing pipeline systems prohibit any detailed reporting of pipeline develoment on a worldwide basis, brief comments on major systems and projects appear in order. In the Near East, deliveries through the major Tapline crude oil system from Saudi Arabia to the Mediterranean were interrupted for 3 months as a result of terrorist activities in Jordan, and sabotage to pipelines and other petroleum facilities was noted in Syria. These actions, coupled with continued closure of the Suez Canal, provided impetus for continued studies and discussions of the possibility of a major crude oil pipeline from Iran through Turkey to the Mediterranean—a route which presumably would be relatively free of disruptions arising from the Arab-Israeli confrontations and internal disorders in the Arab States east of the Mediterranean.

Operating under pressures of continued increases in crude oil demand in Europe, and assuming that adequate quantities of crude can be made available at Mediterranean ports (either from Near East or North African sources), development of the Southern European and Trans-Alpine pipeline systems proceeded, and a 100-mile section of pipeline was completed in Yugoslavia—the first element of a proposed major system which may link refineries in Hungary, Czechoslovakia, and Poland, as well as in Yugoslavia, with a Yugoslavian port near the head of the Adriatic Sea, through which non-European crude could be delivered. Elsewhere in Europe, the U.S.S.R. and other Communist countries of East Europe continued to expand the Comecon pipeline system. Additional branches were completed or under construction, and the Soviets began the second, parallel main pipeline, among a variety of other pipeline projects, many of which were aimed at alleviating severe transportation problems in crude oil and refinery product distribution resulting from inadequate rail facilities.

In the Western Hemisphere, perhaps the most significant oil pipeline projects under study and/or development were lines to move crude oil from Alaska's northern slope—the Prudhoe Bay field—to Canadian and U.S. markets. These proposed systems,

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which remained under study at yearend, included (1) the Trans-Alaska pipeline of 800 miles, linking Prudhoe Bay with the Gulf of Alaska port of Valdez (with crude thence moved by sea to West Coast areas, notably the Puget Sound area), and (2) a line linking Prudhoe Bay with the Edmonton, Alberta, area in Canada.

In addition to oil pipeline development, there has been considerable work on gas lines for international movement of that fuel. Most notably, construction continued on the natural gas line from Iran to the southern U.S.S.R., and plans were laid, although work did not start, for several natural gas lines from Prudhoe Bay, Alaska, and the Inuvik and Pointed Mountain regions of Canada's Northwest Territories into Southern Canadian and Northern U.S. market areas.

One final item, noteworthy not because of its size but because it is a "world's first," was the start of construction of an international petrochemical line linking petrochemical plants in West Germany and the Netherlands. This 140-mile, 10-inch line is scheduled for completion during 1970.

PRICES

Generally speaking, 1969 was a year for advancing prices for mineral commodities in most parts of the world. In the three main non-Communist world steel-producing areas—Western Europe, the United States, and Japan—prices for steel semimanufactures almost without exception advanced during 1969. EEC export prices for merchant bars, heavy sections, heavy plates, and cold-reduced sheets at yearend 1969 stood 45 to 80 percent higher than at yearend 1968, in the range of $130 to $165 per ton, and domestic prices in these nations, while not advancing as sharply as export prices, also increased significantly. Similarly, Japanese domestic prices for these shapes trended upward rather sharply, although starting at a lower base, peaking for the year early in the last quarter and then falling somewhat to reach the range of $129 to $147 per metric ton by yearend. In the United States, the trend was also upward, but the growth in domestic prices from levels of $134 to $159 per ton in 1968 to levels of $142 to $168 in 1969 was far less dramatic than that registered for the nations of non-Communist Europe and Japan.

Major nonferrous metal prices for 1967–69, with 1969 data on a monthly basis, are presented for the United States, the United Kingdom, and Canadian markets in tables 22, 23, and 24, respectively. The aluminum price advanced in each market twice during the year—first in January and subsequently in October—extending the pattern of previous years and reflecting market firmness despite the sizable output increases of 1968 and 1969. The monthly average price of copper moved steadily upward on Canadian and U.S. markets throughout the year. In the United Kingdom, the generally rising copper price, while showing a minor reduction for March and a more sizable reduction in September and October, nonetheless registered the largest percentage gain, comparing the average January price to the average December price—up 35.4 percent, compared with 25.7 percent on the Canadian Market and 20.7 percent on the U.S. market. It is noteworthy that these price increases occurred concurrently with a growth in world copper output of 9.3 percent in the case of mine copper and 8.5 percent in the case of primary smelter copper.

Lead and zinc prices, which had slumped during 1968 on the Canadian and U.S. markets, reversed their direction and reached 1969 yearly averages that exceeded those of both 1968 and 1967, while on the London market, the price of these metals continued to climb; the average monthly zinc price increased constantly except for minor drops in February and October, and the average monthly lead price advanced constantly except for a modest decline in September and October.

The average London market price for tin for 1969 was higher than that recorded for any year since 1965, as a result of an almost constant increase from month to month during the year.

In contrast to the major nonferrous base metals, the silver price on all three markets fell off somewhat over the year 1969, resulting in a yearly average price in excess of that attained in 1967, but below the 1968 peak price.

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Tables 25 and 26 give the United Nations calculated export price indexes for mineral commodities. A declining trend in export prices noted for 1964–68 was reversed in 1969 in the case of the overall crude mineral export price index, as was a 1965–68 decline in the metal ores index. The export fuel price index for the year as a whole stood on a par with that of 1968—at the 1963 level. As in 1968, the developed nations' export price indexes for total minerals stood at an appreciably higher level than did the same index for less developed countries. For the nonferrous base metal export price indexes, the situation was reversed, with the index for less developed areas considerably ahead of that for the developed countries.

Details on world prices of other mineral commodities are generally not available in forms that are reasonably suitable for comparison without detailed analysis. Nonetheless, it appears that the general trend in prices for crude oil and petroleum refinery products—the broad group that accounts for the largest single part of total mineral production value—advanced somewhat in 1969.

STATISTICAL SUMMARY OF WORLD PRODUCTION AND TRADE OF MAJOR COMMODITIES

The final 28 tables in this chapter (tables 27 to 54) extend the statistical series started in the 1963 edition of Volume IV and updated in the 1965, 1967, and 1968 editions. They are provided both as a supplement to other statistical data within the chapter and as a summary of international production and trade data for major commodities covered in greater detail on a commodity basis in Volume I–II of the Minerals Yearbook and on a country basis in Volume IV. The data presented here on production (tables 27 to 43) include all revisions in reported data and in estimates that were available to the authors through September 30, 1970, and therefore should be considered more reliable, complete, and up-to-date than foreign production data appearing elsewhere throughout the 1969 Minerals Yearbook. The data on world trade in major commodities presented in this chapter (tables 44 to 54) may not correspond exactly to those presented elsewhere in the Minerals Yearbook owing to differences in sources that were necessary in order to obtain data on a consistent basis for these summary tables. Differences, however, are regarded as inconsequential from the viewpoint of displaying the general pattern of trade in these commodities. It should be noted that this section contains two tables (49 and 51) that were not included in previous editions of this chapter, giving trade in metallic lead (bullion and refined) and refined zinc metal. These tables supplement tables 48 and 50 that give the trade in lead and zinc metal, respectively, in the form of ores and concentrates, thus making a more complete picture of trade in these major metals.

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Table 1.—United Nations indexes of world [1] mineral industry production

(1963 = 100)

Industry sector and geographic area	1967	1968	1969	1969 by quarters			
				1st	2d	3d	4th
EXTRACTIVE INDUSTRIES							
Metals:							
Non-Communist world	115	121	126	121	129	128	127
Industrialized countries [2]	114	121	125	120	129	125	126
United States and Canada	115	122	125	121	130	123	125
Europe	108	117	123	123	128	119	123
European Economic Community [3]	92	95	96	97	100	91	95
Less industrialized countries [4]	118	121	129	122	127	135	130
Latin America [5]	122	124	131	123	131	139	131
Asia, East and Southeast [6]	119	120	127	121	121	134	130
Communist Europe [7]	149	161	170	170	170	172	167
World	123	130	136	132	138	138	136
Coal:							
Non-Communist world	94	91	90	92	90	85	91
Industrialized countries [2]	92	89	87	90	88	82	89
United States and Canada	117	114	114	111	117	110	118
Europe	84	80	77	83	77	71	78
European Economic Community [3]	83	80	79	83	77	75	82
Less industrialized countries [4]	112	114	118	116	120	117	118
Latin America [5]	121	131	135	NA	NA	NA	NA
Asia, East and Southeast [6]	112	116	117	116	119	115	118
Communist Europe [7]	111	114	118	118	115	118	120
World	101	100	101	103	100	98	103
Crude petroleum and natural gas:							
Non-Communist world	126	135	144	139	143	144	150
Industrialized countries [2]	116	121	124	122	124	123	127
United States and Canada	116	120	123	120	124	122	126
Europe	124	133	144	146	136	137	159
European Economic Community [3]	122	133	147	149	139	139	163
Less industrialized countries [4]	140	155	171	163	169	173	179
Latin America [5]	106	109	109	107	107	111	112
Asia, East and Southeast [6]	141	155	169	160	167	171	178
Communist Europe [7]	145	157	164	163	166	164	163
World	130	140	148	144	149	148	152
Total extractive industry:							
Non-Communist world	118	124	130	126	131	130	134
Industrialized countries [2]	111	115	118	115	119	117	121
United States and Canada	117	120	124	119	125	123	126
Europe	99	102	105	106	104	100	108
European Economic Community [3]	99	105	111	112	108	106	117
Less industrialized countries [4]	133	146	159	152	157	161	165
Latin America [5]	111	113	116	112	114	120	117
Asia, East and Southeast [6]	137	149	161	153	160	163	169
Communist Europe [7]	132	141	144	144	144	144	144
World	122	129	134	132	135	134	137
PROCESSING INDUSTRIES							
Base metals:							
Non-Communist world	123	133	147	144	149	141	150
Industrialized countries [2]	123	132	146	144	149	140	149
United States and Canada	117	122	132	132	137	125	131
Europe	118	131	145	145	148	137	149
European Economic Community [3]	119	133	148	147	150	143	152
Less industrialized countries [4]	127	141	156	150	154	160	162
Latin America [5]	127	141	162	150	161	171	169
Asia, East and Southeast [6]	129	139	151	155	148	147	157
Communist Europe [7]	136	147	156	156	155	156	156
World	127	137	149	148	151	145	152
Nonmetallic mineral products:							
Non-Communist world	123	131	141	126	144	148	145
Industrialized countries [2]	122	130	138	123	143	146	142
United States and Canada	118	124	132	120	136	141	133
Europe	122	130	137	118	144	145	141
European Economic Community [3]	117	126	133	111	141	145	138
Less industrialized countries [4]	133	142	157	142	156	161	168
Latin America [5]	130	146	149	140	151	150	156
Asia, East and Southeast [6]	135	142	166	146	163	173	183
Communist Europe [7]	143	153	164	162	167	161	168
World	131	140	150	137	152	152	154
Chemicals, petroleum, and coal products:							
Non-Communist world	137	152	167	162	167	166	172
Industrialized countries [2]	138	153	168	163	169	166	172
United States and Canada	132	143	153	150	154	153	155
Europe	143	161	181	177	183	175	187
European Economic Community [3]	145	166	187	182	190	183	193
Less industrialized countries [4]	133	148	159	152	156	162	166
Latin America [5]	133	147	159	NA	NA	NA	NA
Asia, East and Southeast [6]	133	148	162	155	155	164	172
Communist Europe [7]	159	176	196	192	196	198	196
World	142	157	173	168	173	172	177

See footnotes at end of table.

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Table 1.—United Nations indexes of world [1] mineral industry production—Continued

(1963 = 100)

Industry sector and geographic area	1967	1968	1969	1969 by quarters			
				1st	2d	3d	4th
PROCESSING INDUSTRIES—Continued							
Overall industrial production:							
Non-Communist world	127	135	145	142	145	143	151
Industrialized countries [2]	126	135	144	141	145	142	150
United States and Canada	127	133	139	137	140	139	140
Europe	119	128	139	137	140	132	148
European Economic Community [3]	117	127	141	138	142	135	151
Less industrialized countries [4]	131	141	152	148	150	154	157
Latin America [5]	126	134	142	NA	NA	NA	NA
Asia, East and Southeast [6]	133	145	157	153	155	158	163
Communist Europe [7]	139	151	162	162	163	160	162
World	130	140	150	147	150	148	154

NA Not available.

[1] Excludes a number of countries of the Near East and Africa as well as mainland China, North Korea, and North Vietnam.

[2] All countries having a per capita value added in manufacturing in 1958 equivalent to US$125 or more.

[3] Belgium, France, West Germany, Italy, Luxembourg, and the Netherlands.

[4] Countries having a per capita value added in manufacturing in 1958 of less than US$125.

[5] Central and South America and the Caribbean Islands.

[6] Afghanistan, Brunei, Burma, Ceylon, Hong Kong, India, Indonesia, Iran, South Korea, Malaysia (excluding Sabah), Mongolia, Pakistan, Philippines, Singapore, Taiwan, Thailand, and South Vietnam.

[7] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and U.S.S.R.

Source: United Nations. Monthly Bulletin of Statistics. August 1970, pp. x-xxi.

Table 2.—World production [1] of major mineral commodities

Commodity	1967	1968	1969 [p]
METALS			
Aluminum:			
Bauxite thousand metric tons	44,521	45,875	52,375
Alumina do	15,618	16,924	19,133
Unalloyed ingot metal do	7,570	8,053	9,074
Antimony do	58	61	65
Arsenic, white [2] do	59	60	49
Beryl metric tons	[3] 4,937	6,549	[3] 7,178
Bismuth [2] do	3,376	3,703	3,743
Cadmium do	13,199	14,769	17,433
Chromite thousand metric tons	4,575	4,901	5,256
Cobalt [2] metric tons	20,012	20,668	20,478
Columbium-tantalum concentrates [2] [3] do	9,322	9,004	13,268
Copper:			
Mine thousand metric tons	5,038	5,488	5,999
Smelter do	5,426	6,100	6,620
Gold thousand troy ounces	45,737	46,155	46,418
Iron and steel:			
Iron ore thousand metric tons	622,709	685,246	723,849
Pig iron (including ferroalloys) do	356,503	386,015	418,183
Steel ingots (including castings) do	493,580	529,083	573,698
Lead:			
Mine do	2,860	2,992	3,212
Smelter do	2,814	2,950	3,249
Magnesium do	189	193	206
Manganese ore do	16,940	17,409	18,259
Mercury thousand 76-pound flasks	232	258	285
Molybdenum metric tons	65,635	66,569	75,413
Nickel thousand metric tons	449	496	487
Platinum-group metals thousand troy ounces	3,175	3,394	3,387
Selenium [4] metric tons	945	918	1,456
Silver thousand troy ounces	257,292	274,699	288,421
Tellurium [3] metric tons	123	117	194
Tin:			
Mine [2] long tons	214,233	227,935	223,609
Smelter do	219,175	230,768	224,458
Titanium concentrates:			
Ilmenite [3] thousand metric tons	2,755	2,934	3,214
Rutile [2] [3] do	282	307	378
Tungsten concentrate (contained tungsten) metric tons	28,617	32,149	32,480
Uranium oxide (U_3O_8) [3] do	17,194	20,670	20,489
Vanadium [3] do	9,733	10,755	12,425
Zinc:			
Mine thousand metric tons	4,837	5,001	5,321
Smelter do	4,127	4,584	5,008

See footnote at end of table.

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Table 2.—World production [1] of major mineral commodities—Continued

Commodity	1967	1968	1969 [p]
NONMETALS			
Asbestos ..... thousand metric tons	2,910	2,982	3,305
Barite ..... do	3,552	3,600	3,631
Cement, hydraulic ..... do	479,988	518,593	540,125
Diamond:			
Gem ..... thousand carats	9,435	10,450	11,290
Industrial ..... do	30,937	30,359	29,428
Diatomite ..... thousand metric tons	1,565	1,590	1,608
Feldspar ..... do	2,070	2,242	2,340
Fluorspar ..... do	3,174	3,545	3,783
Graphite [2] ..... do	358	437	378
Gypsum ..... do	47,649	50,017	51,994
Magnesite [2] ..... do	10,204	10,720	11,553
Mica ..... do	179	192	202
Nitrogen fertilizers, contained nitrogen [3] ..... do	22,221	25,285	27,744
Phosphate rock ..... do	77,937	84,016	81,897
Potash (marketable), K_2O equivalent ..... do	15,762	16,722	16,692
Pumice [2] ..... do	14,047	13,568	14,286
Pyrites, including cupreous ..... do	22,511	22,470	[r] 22,114
Salt ..... do	118,951	126,362	133,963
Strontium minerals [2] ..... metric tons	10,399	12,951	27,527
Sulfur:			
Native ..... thousand metric tons	11,398	12,247	12,006
Byproduct elemental ..... do	6,516	6,678	7,348
Talc, soapstone, and pyrophyllite ..... do	4,033	4,496	4,683
Vermiculite [2] ..... do	336	380	422
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite ..... do	181,238	183,279	181,077
Bituminous ..... do	1,816,754	1,886,290	1,940,175
Lignite ..... do	718,766	735,798	755,394
Total ..... do	2,716,758	2,805,367	2,876,646
Coke:			
Metallurgical ..... do	303,882	315,164	329,971
Other types ..... do	31,686	29,103	27,649
Fuel briquets ..... do	142,494	142,763	144,420
Gas, natural (marketed) ..... billion cubic feet	28,409	31,088	34,015
Peat ..... thousand metric tons	198,156	188,363	199,737
Petroleum, crude ..... thousand barrels	12,889,252	14,104,198	15,219,022

[p] Preliminary.
[1] Incorporates numerous revisions from world production tables and country production tables appearing in Volumes I–II and IV respectively of the Minerals Yearbook. Data revised through Sept. 30, 1970.
[2] U.S. data withheld to avoid disclosing individual company data.
[3] Excludes production from Communist countries: Albania, Bulgaria, Cuba, Czechoslovakia, East Germany, Hungary, mainland China, Mongolia, North Korea, North Vietnam, Poland, Rumania, U.S.S.R., and Yugoslavia.
[4] Excludes production from Communist countries other than Yugoslavia.
[5] Fiscal years ending June 30.

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Table 3.—Approximate percentage distribution of world mineral commodity production, by major areas in 1969 [1]

Commodity	Western Hemisphere			Eastern Hemisphere							World	
				Europe			Near East and Asia					
	North and Central America [2]	South America	Total	Non-Communist [3]	Communist [4]	Africa	Non-Communist	Communist [5]	Oceania	Total	Non-Communist	Communist [6]
METALS												
Aluminum:												
Alumina	46.0	6.9	52.9	13.1	12.5	3.0	7.2	1.2	10.1	47.1	86.3	13.7
Bauxite	27.0	18.4	45.4	13.5	13.6	6.1	5.4	.9	15.1	54.6	85.5	14.5
Ingot	49.3	1.2	50.5	20.5	16.5	1.8	8.0	1.3	1.4	49.5	82.2	17.8
Antimony	7.0	21.4	28.4	5.4	11.0	30.1	5.4	18.4	1.3	71.6	70.6	29.4
Arsenic, white	[e] 16.9	1.6	18.5	64.6	14.5	1.0	1.4	(7)	----	81.5	85.5	14.5
Beryl	(8)	46.2	46.2	.4	17.4	17.9	18.1	----	----	53.8	82.6	17.4
Bismuth	[e] 24.9	34.6	59.5	4.9	1.4	.2	21.6	6.7	5.7	40.5	91.9	8.1
Cadmium	39.6	1.0	40.6	19.3	15.6	4.5	16.2	.5	3.3	59.4	83.9	16.1
Chromite	(7)	.3	.3	2.7	40.5	30.8	25.7	(7)	----	99.7	59.5	40.5
Cobalt	[e] 14.6	----	14.6	11.9	7.3	64.7	----	----	1.5	85.4	85.2	14.8
Columbium-tantalum [9]	[e] 20.6	65.3	85.9	.1	XX	12.8	.7	XX	.5	14.1	100.0	XX
Copper:												
Mine	32.9	15.3	48.2	3.2	17.0	22.2	5.3	1.9	2.2	51.8	81.1	18.9
Smelter	28.8	12.6	41.4	9.9	15.9	19.3	10.1	1.7	1.7	58.6	82.4	17.6
Gold	9.7	1.4	11.1	.4	13.5	70.5	2.2	.5	1.8	88.9	86.0	14.0
Iron and steel:												
Iron ore	18.6	10.3	28.9	18.2	27.4	7.9	5.6	6.6	5.4	71.1	66.0	34.0
Pig iron (including ferroalloys)	23.4	1.4	24.8	26.0	24.9	1.2	16.3	5.3	1.5	75.2	69.8	30.2
Steel ingots and castings	24.6	1.5	26.1	27.0	25.6	1.0	16.0	3.1	1.2	73.9	71.3	28.7
Lead:												
Mine	29.5	7.7	37.2	14.7	19.6	5.6	3.7	5.3	13.9	62.8	75.1	24.9
Smelter	28.3	3.8	32.1	21.9	20.6	3.8	6.3	4.7	10.6	67.9	74.7	25.3
Magnesium	48.8	----	48.8	24.3	21.9	----	4.5	.5	----	51.2	77.6	22.4
Manganese ore	.7	12.1	12.8	.6	39.9	25.0	11.1	5.4	5.2	87.2	54.7	45.3
Mercury	25.1	1.4	26.5	44.9	16.6	.1	4.9	7.0	----	73.5	76.4	23.6
Molybdenum	80.5	6.7	87.2	.3	10.0	(7)	.5	2.0	(7)	12.8	88.0	12.0
Nickel	49.7	.2	49.9	1.9	21.9	4.1	1.4	----	20.8	50.1	70.8	29.2
Platinum-group metals	8.5	.8	9.3	----	62.0	28.5	.2	----	----	90.7	38.0	62.0
Selenium [9]	74.0	.5	74.5	10.0	XX	1.8	13.5	XX	.2	25.5	100.0	XX
Silver	45.4	16.2	61.6	6.1	15.2	2.9	5.1	.5	8.6	38.4	84.3	15.7
Tellurium [9]	79.1	8.9	88.0	----	XX	----	12.0	XX	(7)	12.0	100.0	XX
Tin:												
Mine	[e] .2	14.7	14.9	1.1	12.6	9.0	50.0	8.9	3.5	85.1	78.5	21.5
Smelter	.2	.6	.8	18.1	12.6	5.3	52.5	8.9	1.8	99.2	78.5	21.5
Titanium:												
Ilmenite [9]	47.4	.6	48.0	20.5	XX	.8	8.5	XX	22.2	52.0	100.0	XX
Rutile [9]	(8)	(10)	(10)	----	XX	3.6	1.4	XX	95.0	100.0	100.0	XX
Tungsten	18.5	9.8	28.3	4.5	20.0	1.4	10.8	31.2	3.8	71.7	48.8	51.2
Uranium oxide (U_3O_8) [6]	69.6	.2	69.8	8.4	XX	20.3	(7)	XX	1.5	30.2	100.0	XX
Vanadium [9]	40.7	----	40.7	18.2	XX	41.1	----	XX	----	59.3	100.0	XX
Zinc:												
Mine	37.0	7.0	44.0	13.9	16.2	5.8	6.4	4.2	9.5	56.0	79.6	20.4
Smelter	28.9	1.9	30.8	25.9	18.2	2.5	14.7	3.0	4.9	69.2	78.8	21.2

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NONMETALS												
Asbestos	47.8	.1	47.4	4.2	30.8	11.5	1.8	4.8	(10)	52.6	64.9	35.1
Barite	35.3	2.7	38.0	32.7	11.6	3.4	6.2	7.2	.9	62.0	81.2	18.8
Cement, hydraulic	16.4	3.6	20.0	31.3	24.0	2.8	18.4	2.5	1.0	80.0	73.5	26.5
Diamond:												
Gem	----	2.7	2.7	----	13.3	83.8	.2	----	----	97.3	86.7	13.3
Industrial	----	.9	.9	----	20.4	78.7	(10)	----	----	99.1	79.6	20.4
Diatomite	35.4	2.8	38.2	36.7	22.4	1.6	.2	----	.9	61.8	77.6	22.4
Feldspar	33.4	1.9	35.3	44.2	11.9	1.6	6.7	----	.3	64.7	88.1	11.9
Fluorspar	33.2	.5	33.7	30.8	12.7	4.1	9.3	9.4	----	66.3	77.9	22.1
Graphite	[6] 11.5	.7	12.2	12.7	18.8	4.7	23.4	28.2	----	87.8	53.0	47.0
Gypsum	32.4	1.9	34.3	38.5	12.3	2.1	9.9	1.1	1.8	65.7	86.6	13.4
Magnesite	([5])	1.6	1.6	24.8	46.3	.4	4.2	22.5	.2	98.4	31.2	68.8
Mica, including scrap	60.1	1.0	61.1	3.1	18.3	4.1	13.4	(7)	----	38.9	81.7	18.3
Nitrogen fertilizers, contained nitrogen	27.0	.9	27.9	29.6	24.3	1.0	13.0	3.9	.3	72.1	71.8	28.2
Phosphate rock	41.9	.3	42.2	(10)	23.6	23.7	4.0	3.1	3.4	57.8	73.3	26.7
Potash, K_2O equivalent (marketable)	32.3	----	32.3	32.8	32.9	----	2.0	----	----	67.7	67.1	32.9
Pumice	24.0	1.3	25.3	74.5	XX	.1	(7)	XX	.1	74.7	100.0	XX
Pyrites, including cupreous	[6] 1.3	----	1.3	35.1	21.7	5.8	25.1	10.4	.6	98.7	67.9	32.1
Salt	35.9	3.5	39.4	23.8	14.2	1.5	8.6	11.7	.8	60.6	74.1	25.9
Strontium minerals [8]	65.7	.2	65.9	31.9	XX	----	2.2	XX	----	34.1	100.0	XX
Sulfur:												
Native	69.2	1.7	70.9	.5	25.6	----	2.0	1.0	----	29.1	73.4	26.6
Byproduct elemental	57.1	.1	57.2	29.4	8.3	.5	2.9	1.7	----	42.8	90.0	10.0
Talc, soapstone, and pyrophyllite	21.5	1.9	23.4	14.4	10.9	.9	45.0	4.5	.9	76.6	84.6	15.4
Vermiculite [8]	66.5	1.6	68.1	----	XX	30.7	1.2	XX	----	31.9	100.0	XX
MINERAL FUELS AND RELATED MATERIALS												
Coal, all grades including lignite	18.4	.3	18.7	17.1	41.8	2.0	5.4	12.5	2.5	81.3	45.7	54.3
Coke:												
Metallurgical	19.5	.8	20.3	28.1	31.1	1.1	12.2	5.8	1.4	79.7	63.1	36.9
Other types	----	.7	.7	25.0	41.7	.7	29.4	----	2.5	99.3	58.3	41.7
Fuel briquets	28.4	(7)	28.4	14.8	47.1	(10)	8.7	----	1.0	71.6	52.9	47.1
Gas, natural (marketed)	67.7	1.8	69.5	5.8	22.1	.3	2.3	----	(10)	30.5	77.9	22.1
Peat	.4	(7)	.4	4.4	95.2	----	(10)	----	----	99.6	4.8	95.2
Petroleum, crude	26.2	10.8	37.0	.9	16.6	12.1	32.3	1.0	.1	63.0	82.4	17.6

XX Not applicable.

[1] Data presented in this table have been calculated from production figures that include additions and revisions to all data appearing elsewhere in the 1969 Minerals Yearbook. Data revised through Sept. 30, 1970.

[2] Includes Cuba.

[3] Includes Yugoslavia.

[4] Includes Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and U.S.S.R.

[5] Includes mainland China, Mongolia, North Korea, and North Vietnam.

[6] U.S. data withheld to avoid disclosing individual company data and not included in total upon which percentages have been calculated.

[7] Quantity of production not known. No estimate included in total.

[8] Excludes production from Communist countries: Albania, Bulgaria, Cuba, Czechoslovakia, East Germany, Hungary, mainland China, Mongolia, North Korea, North Vietnam, Poland, Rumania, U.S.S.R. and Yugoslavia.

[9] Excludes production from Communist countries other than Yugoslavia.

[10] Less than .05 percent.

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Table 4.—Value of world export trade in major mineral commodity groups [1]

(Million U.S. dollars)

Commodity group [1]	1964	1965	1966	1967	1968
Metals:					
All ores, concentrates and scrap	4,370	4,580	r 4,770	5,050	5,580
Iron and steel	8,640	9,700	9,670	10,330	11,410
Nonferrous metals	5,630	6,690	8,020	8,030	9,480
Total	18,640	20,970	22,460	23,410	26,470
Nonmetals (crude only)	1,530	1,760	1,900	2,010	2,120
Mineral fuels	17,010	17,920	18,890	20,660	22,950
Grand total	37,180	40,650	43,250	46,080	51,540
All commodities	172,160	186,390	203,400	r 214,190	238,680

r Revised.

[1] Data presented are for selected major commodity groups of the Standard International Trade Classification—Revised (SITC-R) and as such exclude some mineral commodities classified in that data array together with other (nonmineral) commodities. SITC-R categories included are as follows: Ores, concentrates, and scrap—SITC Division 28; iron and steel—SITC Division 67; nonferrous metals—SITC Division 68; nonmetals (crude only)—SITC Division 27; Mineral fuels—SITC Section 3. Major items not included are the metals, metalloids, and metal oxides of SITC Group 513; mineral tar and crude chemicals from coal, petroleum, and natural gas of SITC Division 52; manufactured fertilizers of SITC Division 56; and nonmetallic mineral manufactures of SITC Groups 661, 662, 663, and 667.

Table 5.—Distribution of total value of export trade in major mineral commodity groups, by group [1]

(Percent)

Commodity group [1]	1964	1965	1966	1967	1968
Metals:					
All ores, concentrates and scrap	11.8	11.3	11.0	11.0	10.8
Iron and steel	23.2	23.9	22.4	22.4	22.2
Nonferrous metals	15.1	16.4	18.5	17.4	18.4
Total	50.1	51.6	51.9	50.8	51.4
Nonmetals (crude only)	4.1	4.3	4.4	4.4	4.1
Mineral fuels	45.8	44.1	43.7	44.8	44.5
Grand total	100.0	100.0	100.0	100.0	100.0

[1] For detailed definition of groups, see footnote 1, table 4.

Table 6.—Growth of value of export trade in major mineral commodity groups [1]

(Percent increase over previous year)

Commodity group [1]	1964	1965	1966	1967	1968
Metals:					
All ores, concentrates and scrap	20.1	4.8	4.1	5.9	10.5
Iron and steel	17.7	12.3	−.3	6.8	10.5
Nonferrous metals	19.3	18.8	19.9	.1	18.1
All metals	18.7	12.5	7.1	4.2	13.1
Nonmetals (crude only)	17.7	15.0	8.0	5.8	5.5
Mineral fuels	8.3	5.4	5.4	9.4	11.1
All major mineral commodity groups	13.7	9.3	6.4	6.5	11.8
All commodity groups	11.9	8.3	9.1	5.3	11.1

[1] For detailed definitions of groups, see footnote 1, table 4.

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Table 7.—Significance of trade in major mineral commodity groups [1] to total trade of various world areas, 1968

Area and country [2]	Value, million U.S. dollars				Major mineral commodities' share of total (percent)	
	Major mineral commodity groups [1]		All commodities			
	Exports from	Exports to	Exports from	Exports to	Exports from	Exports to
Northern North America:						
Canada	3,625	1,475	12,560	10,900	28.9	13.5
United States	3,205	7,665	34,230	31,950	9.4	24.0
Total	6,830	9,140	46,790	42,850	14.6	21.3
Latin America	[3] 4,765	1,626	12,190	12,120	[4] 39.1	13.4
Europe:						
Non-Communist:						
EEC	10,445	14,910	64,200	59,520	16.3	25.1
EFTA	[5] 4,715	7,525	30,980	35,350	12.6	21.3
Other		2,065	6,320	10,320		20.0
Subtotal	15,160	24,500	101,500	105,190	14.9	23.3
Communist	5,825	4,390	24,900	23,020	23.4	19.1
Total	20,985	28,890	126,400	128,210	16.6	22.5
Africa:						
Republic of South Africa	[6] 110	350	2,110	2,550	[4] 5.2	13.7
Other	[7] 4,725	1,102	9,720	8,920	[4] 48.6	12.4
Total	[8] 4,835	1,452	11,830	11,470	[4] 40.9	12.7
Near East	[9] 7,320	879	8,730	6,130	[4] 83.8	14.3
South Asia and Far East:						
Non-Communist:						
Japan	[10] 1,901	4,425	12,970	10,920	[4] 14.7	40.5
Other	[3] 1,735	2,301	11,170	15,570	[4] 15.5	14.8
Subtotal	[8] 3,636	6,726	24,140	26,490	[4] 15.1	25.4
Communist	[9] 142	501	2,060	2,360	[4] 6.9	21.2
Total	[8] 3,778	7,227	26,200	28,850	[4] 14.4	25.1
Australia and New Zealand	[9] 465	607	4,300	4,310	[4] 10.8	14.1
Rest of world	[10] 1,270	1,109	2,250	3,220	[4] 56.4	34.4
Not reported	[11] 1,292	610	[12] −10	1,520	([13])	42.0
Grand total	51,540	51,540	238,680	238,680	21.6	21.6

See footnotes at end of table.

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Table 7.—Significance of trade in major mineral commodity groups [1] to total trade of various world areas, 1968—Continued

[1] For detailed definitions of groups, see footnote 1, table 4.
[2] Regional groupings generally conform to United Nations practice; modifications and special aspects of classification scheme are as follows: (1) Latin America includes Mexico, Central America, and South America, but excludes Caribbean Islands; (2) EEC consists of Belgium, France, West Germany, Italy, Luxembourg, and the Netherlands; (3) EFTA consists of Austria, Denmark, Norway, Portugal, Sweden, Switzerland, and the United Kingdom; (4) other non-Communist Europe consists of Finland, Greece, Iceland, Ireland, and Spain as well as Yugoslavia (a Communist country); (5) Communist Europe includes Albania, Bulgaria, Czechoslovakia, Hungary, Poland Rumania, and the U.S.S.R.; (6) Other Africa corresponds to the United Nations category "Developing Africa;" (7) Near East corresponds to the United Nations category "Asian Middle East;" (8) Other non-Communist South Asia and Far East corresponds to the United Nations category "Other Asia;" (9) Communist Far East consists of China (mainland), North Korea, Mongolia, and North Vietnam; (10) Rest of world is taken directly from source and reportedly consists mainly of Caribbean and Pacific islands; (11) Not reported is derived by subtracting all listed figures from reported totals.
[3] Partial figure, value of nonmetals excluded, but presumably included under "Not reported."
[4] Percentage based on partial figure; see footnote to entry in "Exports from" value column.
[5] Of total listed, $3,815 million is credited to EFTA, $665 million is credited to other non-Communist Europe, and $235 million is credited to the 2 areas together and not differentiated.
[6] Partial figure, value of mineral fuels only; totals for other commodity groups presumably included under "Not reported."
[7] Partial figure; value of iron and steel excluded, but presumably included under "Not reported."
[8] Partial total; see exclusions as indicated by footnotes to regional detail above.
[9] Partial figure; value of metal ores, concentrates, and scrap excluded, but presumably included under "Not reported."
[10] Partial figure; value of iron and steel, nonferrous metals, and nonmetals excluded, but presumably included under "Not reported."
[11] Direct arithmetic sum of the differences between world totals and individual detailed figures for each major commodity reported in source publications; in the case of the mineral fuels component, the detail in the source exceeds the listed total by $12 million, and this has been subtracted from the sum of the positive remainders credited to the remaining 4 commodity groupings in order to maintain the balance between the export from total and the export to total.
[12] As derived from published figures; negative number is not explained in source.
[13] Not calculable, owing to the fact that a considerable part of total dollar value of major mineral commodity exports was not distributed by specific areas and thus appears as a part of the not reported total, while in the case of total commodity trade, the total dollar value was fully distributed.

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Table 8.—Export origins and destinations for major mineral commodity group [1] shipments, by value, in 1968
(Million U.S. dollars)

Area and country [2]	Exports from					Exports to				
	Metal ores, concentrates and scrap	Iron and steel	Nonferrous metals	Nonmetals	Mineral fuels	Metal ores, concentrates and scrap	Iron and steel	Nonferrous metals	Nonmetals	Mineral fuels
Northern North America:										
Canada	1,170	315	1,200	300	640	165	325	175	80	730
United States	540	610	670	325	1,060	930	2,060	1,920	265	2,490
Total	1,710	925	1,870	625	1,700	1,095	2,385	2,095	345	3,220
Latin America	730	85	1,130	[3]	2,820	47	500	275	74	730
Europe:										
Non-Communist:										
EEC	530	4,860	1,970	405	2,680	1,670	2,890	3,220	690	6,440
EFTA	385	1,520	1,290	235	620	780	1,200	1,790	295	3,460
Other [4]	105	120	270		170	110	510	260	115	1,070
Subtotal	1,020	6,500	3,530	640	3,470	2,560	4,600	5,270	1,100	10,970
Communist	530	1,660	700	255	2,680	560	1,640	520	210	1,460
Total [5]	1,550	8,160	4,230	895	6,150	3,120	6,240	5,790	1,310	12,430
Africa:										
Republic of South Africa	[3]	[3]	[3]	[3]	110	7	58	63	42	180
Other	380	[3]	1,290	215	2,840	11	420	79	42	550
Total [5]	[5] 380	[3]	[5] 1,290	[5] 215	2,950	18	478	142	84	730
Near East	[3]	[3]	[3]	[3]	7,320	4	375	77	28	395
South Asia and Far East:										
Non-Communist:										
Japan	[3]	1,710	160	[3]	31	1,170	165	610	110	2,370
Other	420	145	330	[3]	840	71	780	290	80	1,080
Subtotal [4]	[5] 420	1,855	490	[3]	871	1,241	945	900	190	3,450
Communist	[3]	80	41	[3]	21	19	255	120	17	90
Total	[5] 420	1,935	531	[3]	892	1,260	1,200	1,020	207	3,540
Australia and New Zealand	[3]	110	195	[3]	160	4	165	65	53	320
Rest of world	300	[3]	[3]	[3]	970	9	67	14	19	1,000
Not reported [4]	490	195	234	385	[6] −12	23	------	2	------	585
Grand total	5,580	11,410	9,480	2,120	22,950	5,580	11,410	9,480	2,120	22,950

[1] For detailed definitions of groups, see footnote 1, table 4.
[2] For detailed definitions of areas listed below, see footnote 2, table 7.
[3] Not listed separately for this area, presumably included under "Not reported."
[4] Not reported in source but derived from data therein.
[5] Partial total, exclusions indicated by footnote 3 on components of total also apply to total.
[6] Subtraction of listed detail in source from listed total produces a negative number; source offers no explanation.

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Table 9.—Direction of trade in major mineral commodities [1] in 1969

(Million U.S. dollars)

Sources [2]	Destinations [2]									
	Northern North America			Latin America	Non-Communist Europe				Communist Europe	Near East
	United States	Canada	Total [3]		EEC	EFTA	Other [3]	Total [4]		
Northern North America:										
United States	XX	730	730	403	693	251	104	1,048	4	30
Canada	2,180	XX	2,180	72	298	625	36	959	9	9
Total [3]	2,180	730	2,910	475	991	876	140	2,007	13	39
Latin America [5]	1,507	350	1,857	352	717	576	100	1,393	49	2
Europe:										
Non-Communist:										
EEC	1,056	58	1,114	186	5,375	1,802	443	7,620	336	210
EFTA [6]	467	72	539	78	1,250	1,069	251	2,570	183	85
Other [3]	83	4	87	14	360	219	41	620	91	14
Subtotal	1,606	134	1,740	278	6,985	3,090	735	10,810	610	309
Communist	50	8	58	159	673	468	420	1,561	3,055	59
Total [3]	1,656	142	1,798	437	7,658	3,558	1,155	12,371	3,665	368
Near East [7]	200	59	259	130	2,260	1,090	380	3,730	------	340
Africa:										
Republic of South Africa [7]	2	------	2	------	3	1	------	4	------	------
Other [8]	223	9	232	35	2,727	909	209	3,845	46	10
Total [3]	225	9	234	35	2,730	910	209	3,849	46	10
Far East and South Asia:										
Non-Communist:										
Japan [3 9]	864	32	896	95	53	19	18	90	38	68
Other [8]	212	11	223	6	94	66	15	175	44	27
Subtotal [3]	1,076	43	1,119	101	147	85	33	265	82	95
Communist [3 9]	------	------	------	4	15	5	2	22	75	1
Total [3]	1,076	43	1,119	105	162	90	35	287	167	96
Australia and New Zealand [3 9]	34	3	37	1	18	93	4	115	1	1
Rest of world [10]	580	119	699	82	59	155	17	231	------	2
Grand total [4]	7,665	1,475	9,140	1,626	14,910	7,525	2,065	24,500	4,390	879

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Sources [2]	Destinations [2]									
	Africa			Non-Communist Far East and South Asia			Communist Far East	Australia and New Zealand	Rest of world	Grand total [4]
	Republic of South Africa	Other	Total [3]	Japan	Other	Total [3]				
Northern North America:										
United States	20	52	72	497	294	791	------	50	84	3,205
Canada	18	3	21	255	56	311	5	46	6	3,625
Total [3]	38	55	93	752	350	1,102	5	96	40	6,830
Latin America [5]	------	6	6	317	4	321	3	10	770	4,765
Europe:										
Non-Communist:										
EEC	36	343	379	34	117	151	135	15	35	10,445
EFTA [6]	35	76	111	29	79	108	42	62	24	3,815
Other [3]	2	24	26	9	7	16	4	2	2	900
Subtotal	73	443	516	72	203	275	181	79	61	15,160
Communist	------	80	80	214	68	282	147	2	------	5,825
Total [3]	73	523	596	286	271	557	328	81	61	20,985
Near East [7]	140	240	380	1,600	520	2,120	------	200	68	7,320
Africa:										
Republic of South Africa [7]	XX	19	19	5	------	5	------	------	------	110
Other [8]	52	116	168	233	19	252	12	2	38	4,725
Total [3]	52	135	187	238	19	257	12	2	38	4,835
Far East and South Asia:										
Non-Communist:										
Japan [5 9]	10	45	55	XX	450	450	152	62	7	1,901
Other [5]	------	20	20	581	556	1,137	1	89	9	1,785
Subtotal [3]	10	65	75	581	1,006	1,587	153	151	16	3,686
Communist [5 9]	------	3	3	32	18	50	NA	------	------	142
Total [3]	10	68	78	613	1,024	1,637	153	151	16	3,778
Australia and New Zealand [5 9]	7	2	9	150	63	213	------	59	20	465
Rest of world [10]	3	19	22	80	18	98	------	2	79	1,270
Grand total [4]	350	1,102	1,452	4,425	2,301	6,726	501	607	1,109	51,540

NA Not available. XX Not applicable.

[1] For detailed listing of commodities included, see footnote 1, table 4. It should be noted that certain commodities excluded for specific areas indicated by footnotes 5 through 10 are presumably included in grand totals.

[2] For detailed definitions of areas listed, see footnote 2, table 7.

[3] Not reported in source; derived from data therein.

[4] As reported in source, detail may not add to listed figure.

[5] Excludes crude nonmetals.

[6] Excludes crude nonmetals; however, figures for crude nonmetals for this area are included with "Other Europe" on following line, and thus are included in subtotal for non-Communist Europe and total for Europe, as well as in grand total.

[7] Includes mineral fuels only.

[8] Excludes iron and steel.

[9] Excludes metal ores and scrap.

[10] Includes metal ores and scrap and mineral fuels only.

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Table 10.—Iron ore consumption, by selected major countries

(Million metric tons)

Countries	1967	1968	1969
European Economic Community:			
Belgium	16.3	18.6	19.4
France	39.6	41.7	43.7
West Germany	39.2	42.9	47.7
Italy	9.5	e 9.9	9.9
Luxembourg	13.2	14.3	14.8
Netherlands	3.4	4.1	4.9
Total	121.2	131.5	140.4
European Free Trade Association:			
Austria	4.4	4.7	5.4
Norway	.8	.9	.9
Portugal	.2	.2	.3
Sweden	6.1	e 6.7	e 6.8
United Kingdom	28.2	31.0	30.4
Total	39.7	43.5	43.8
Other non-Communist Europe:			
Finland	1.5	1.5	1.7
Spain	5.5	5.6	e 5.7
Total	7.0	7.1	7.4
Communist Europe:			
Czechoslovakia e	13.1	13.1	13.2
Hungary	3.3	3.2	3.2
Poland	13.0	13.5	13.5
U.S.S.R.e	140.0	145.0	150.0
Yugoslavia	2.6	2.6	2.5
Total	172.0	177.4	182.4
Other:			
Japan	51.6	59.4	73.6
Turkey	.9	1.0	1.0
United States	120.8	122.4	130.6
Grand total	513.2	542.3	579.2

e Estimate.

Source: United Nations. Quarterly Bulletin of Steel Statistics for Europe. V. 21, No. 1, 1970, except for estimates which were prepared by the U.S. Bureau of Mines from partial data in the source just cited.

Table 11.—Estimated world [1] consumption of major nonferrous metals

	1967	1968 r	1969
Aluminum [2] thousand metric tons	r 7,231	8,094	8,984
Copper [3] do	6,091	6,436	6,989
Lead [4] do	3,021	3,159	3,449
Zinc [5] do	4,081	4,320	4,568
Tin [6] thousand long tons	r 169	174	181

r Revised.

[1] In general, major consuming countries only have been included; sum of consumption by excluded minor consumers may be significant; data included for Communist countries, except Yugoslavia, are listed as conjectural in source.

[2] Apparently includes secondary metal.

[3] Primary and secondary refined.

[4] Chiefly primary; may include secondary.

[5] Primary and secondary slab.

[6] Primary only. As reported by the International Tin Council. Communist countries, except for Yugoslavia, are excluded.

Source: Yearbook of the American Bureau of Metal Statistics. Forty-Ninth Annual Issue for the Year 1969. New York, 1970, 148 pp.

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Table 12.—World energy consumption,[1] by fuel and continental area

(Million metric tons of standard coal equivalent unless otherwise specified)

Area [2] and year	Solid fuels	Liquid fuels	Natural and imported gas	Hydro, nuclear, and imported electricity	Total aggregate	Total per capita (kilograms)
North America:						
1964	424	758	630	37	1,849	8,743
1965	448	795	657	40	1,940	9,053
1966	471	834	707	42	2,053	9,460
1967	463	875	744	46	2,127	9,685
1968	481	929	799	47	2,255	10,155
Caribbean America:						
1964	5	64	25	2	95	922
1965	4	68	26	2	100	944
1966	4	69	28	2	104	945
1967	5	74	30	3	112	988
1968	5	81	31	3	120	1,032
Other America:						
1964	6	58	9	4	76	566
1965	6	61	10	4	80	578
1966	6	65	10	5	86	605
1967	7	67	11	5	89	610
1968	7	74	12	5	98	653
Western Europe:						
1964	539	416	25	34	1,014	2,986
1965	515	463	28	39	1,045	3,050
1966	486	516	33	43	1,078	3,120
1967	459	549	41	44	1,093	3,139
1968	458	599	58	46	1,161	3,312
Africa:						
1964	49	31	1	2	83	271
1965	53	32	2	2	88	283
1966	52	36	2	2	92	287
1967	54	37	2	2	94	284
1968	56	39	2	2	99	294
Near East:						
1964	6	28	6	[3]	40	456
1965	6	32	6	[3]	44	481
1966	6	34	7	[3]	48	515
1967	6	38	8	[3]	52	548
1968	6	40	10	[3]	56	575
Far East:						
1964	144	133	9	12	298	306
1965	151	152	10	12	324	321
1966	154	174	10	14	352	341
1967	165	206	11	13	394	372
1968	169	241	12	13	436	402
Oceania:						
1964	49	31	1	2	83	271
1965	53	32	2	2	88	283
1966	52	36	2	2	92	287
1967	54	37	2	2	94	284
1968	56	39	2	2	99	294
Countries not elsewhere specified: [4]						
1964	1,021	271	168	14	1,473	1,402
1965	1,035	291	196	16	1,538	1,444
1966	1,080	317	218	18	1,633	1,514
1967	985	342	242	17	1,585	1,450
1968	1,066	372	263	19	1,719	1,553
World total:						
1964	2,224	1,782	871	107	4,984	1,547
1965	2,250	1,919	933	118	5,220	1,583
1966	2,293	2,074	1,015	128	5,510	1,641
1967	2,177	2,216	1,088	131	5,612	1,641
1968	2,284	2,408	1,185	138	6,016	1,727

[1] In most cases, data are aggregates of country figures representing apparent inland consumption—the purely arithmetic result of adding production and imports and subtracting from this sum the total of exports, bunker loadings, and additions to stocks (where the latter are known). All totals in this table are reported in source and may not represent the sum of listed parts owing to rounding and/or ommission from detail in space of minor quantities not listed separately. A large number of the entries in this table have been revised from those appearing in previous editions of this chapter owing to revisions published in new edition of source; such revisions have not been identified as such by footnotes.

[2] Areas listed are those appearing in the source and have not been conformed in scope to standard terms used elsewhere in the Minerals Yearbook, except that the source term "Western Asia" has been converted to "Near East".

[3] Nil or less than ½ unit.

[4] The greatest part of the consumption listed under this heading is that of Eastern Europe—Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and the U.S.S.R.

Source: United Nations. World Energy Supplies 1965–68. Statistical Papers, Series J, No. 13, New York, 1970, pp. 10–18.

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Table 13.—Annual investment expenditures in the steel industry for selected countries

(Million dollars)

	1967	1968	1969
European Economic Community (EEC) [1]	780	r 802	1,017
European Free Trade Association (EFTA) [2]	272	211	202
Other countries:			
Canada	108	NA	NA
Finland	NA	1	6
Ireland	1	(3)	(3)
Japan [4]	842	1,167	1,494
Spain	186	213	221
Turkey	10	8	NA
United States	2,173	r 2,372	2,136

r Revised. NA Not available.

[1] European Coal and Steel Commission. Investment in the Community Coal Mining and Steel Industries. Report on the 1970 Survey, 1970, p. 8.

[2] Totals given exclude expenditures, if any, for Denmark and Switzerland in every year, and for 1969 and also exclude Austria, Norway, Portugal, and any non British Steel Corporation investment in the United Kingdom.

[3] Less than ½ unit.

[4] Japanese fiscal years.

Source: Except as otherwise noted, Organization for Economic Cooperation and Development, The Iron and Steel Industry in 1969 and Trends in 1970, and previous editions of the same publication covering 1967 and 1968, and 1968 and 1969.

Table 14.—Non-Communist world petroleum industry capital expenditures and exploration expenses by geographic area

(Million dollars)

	1966	1967	1968	1969
United States:				
Capital expenditures	7,125	7,650	8,350	8,175
Exploration expenses	650	615	715	725
Total	7,775	8,265	9,065	8,900
Other Western Hemisphere:				
Capital expenditures	1,785	1,860	2,490	2,715
Exploration expenses	210	250	265	270
Total	1,995	2,110	2,755	2,985
Western Europe:				
Capital expenditures	2,500	2,725	2,625	2,480
Exploration expenses	75	100	125	125
Total	2,575	2,825	2,750	2,605
Africa:				
Capital expenditures	560	600	785	825
Exploration expenses	75	100	75	85
Total	635	700	860	910
Near East:				
Capital expenditures	600	550	625	730
Exploration expenses	50	50	50	50
Total	650	600	675	780
Far East:				
Capital expenditures	840	975	1,425	1,500
Exploration expenses	50	75	100	125
Total	890	1,050	1,525	1,625
Unspecified: Capital expenditures (no exploration expenses)	1,265	1,215	1,600	1,950
Total:				
Capital expenditures	14,675	15,575	17,900	18,375
Exploration expenses	1,110	1,190	1,330	1,330
Total	15,785	16,765	19,230	19,755

Source: Energy Division, Chase Manhattan Bank N.A. Capital Investments of the World Petroleum Industry–1969, pp. 24–30.

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Table 15.—Non-Communist world petroleum industry capital expenditures by industry sector and exploration expenses
(Million dollars)

	1966	1967	1968	1969
Capital expenditures:				
Production	5,640	6,000	7,460	7,540
Pipelines	760	860	1,080	910
Marine	1,295	1,280	1,675	2,090
Refineries	2,670	2,585	2,950	3,210
Chemical plants	1,340	1,565	1,480	1,310
Marketing	2,410	2,705	2,665	2,805
Other	560	580	590	510
Total	14,675	15,575	17,900	18,375
Exploration expenses	1,110	1,190	1,330	1,380
Grand total	15,785	16,765	19,230	19,755

Source: Energy Division, Chase Manhattan Bank, N.A. Capital Investment of the World Petroleum Industry–1969, pp. 24–25.

Table 16.—U.S. direct foreign investment in mineral industries: Value, earnings and income
(Million dollars)

Area and country	Mining and smelting			Petroleum		
	Value	Earnings [1]	Income [2]	Value	Earnings [1]	Income [2]
1967						
Canada	r 2,842	240	154	3,819	207	132
Latin American Republics:						
South America:						
Venezuela	NA	NA	NA	r 1,798	880	374
Other	NA	NA	NA	r 724	80	65
Subtotal	r 1,124	265	250	r 2,517	460	439
Other	153	30	15	r 386	15	6
Total	1,277	295	265	r 2,903	475	445
Other Western Hemisphere	431	101	100	r 569	57	35
Europe:						
EEC	19	NA	NA	r 2,086	−24	35
Non-EEC:						
United Kingdom	2	(3)	(3)	r 1,432	−53	−17
Other	40	NA	NA	r 905	−22	−12
Total Europe	61	6	7	r 4,423	−99	6
Africa:						
Republic of South Africa	99	45	29	r 139	NA	NA
Other	r 301	29	31	r 1,080	NA	NA
Total	r 400	74	60	r 1,219	268	252
Near East	3	--------	--------	r 1,608	983	1,010
Far East	40	5	1	992	115	87
Oceania:						
Australia	320	20	8	NA	NA	NA
Other	2	1	1	NA	NA	NA
Total	322	21	9	r 592	−4	−19
International shipping	--------	--------	--------	r 1,279	117	41
Grand total [4]	r 4,876	743	596	r 17,404	2,118	1,989
1968						
Canada	2,638	285	180	4,094	243	160
Latin American Republics:						
South America:						
Venezuela	NA	NA	(3)	1,780	387	380
Other	NA	NA	254	825	73	64
Subtotal	1,273	265	254	2,605	460	444
Other	137	29	21	409	18	8
Total	1,410	294	275	3,014	478	452
Other Western Hemisphere	519	98	99	667	57	41

See footnotes at end of table.

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Table 16.—U.S. direct foreign investment in mineral industries: Value, earnings and income—Continued

(Million dollars)

Area and country	Mining and smelting			Petroleum		
	Value	Earnings [1]	Income [2]	Value	Earnings [1]	Income [2]
Europe:						
EEC	19	(3)	(3)	2,146	−51	34
Non-EEC:						
United Kingdom	2	NA	NA	1,563	−46	−12
Other	40	NA	NA	927	−37	−18
Total Europe	61	8	6	4,636	−134	4
Africa:						
Republic of South Africa	81	31	32	148	(3)	(3)
Other	314	38	31	1,407	501	483
Total	395	69	63	1,555	501	483
Near East	3	--------	--------	1,656	1,079	1,069
Far East	44	NA	NA	1,158	104	75
Oceania:						
Australia	365	38	23	NA	(3)	NA
Other	(3)	1	(3)	NA	(3)	NA
Total	365	34	23	639	−5	−18
International shipping	--------	--------	--------	1,469	144	22
Grand total [4]	5,435	789	645	18,887	2,466	2,288
1969 [p]						
Canada	2,764	233	152	4,359	223	152
Latin American Republics:						
South America:						
Venezuela	NA	NA	NA	1,771	334	329
Other	NA	NA	NA	880	68	64
Subtotal	1,183	161	285	2,651	402	393
Other	163	288	9	428	10	2
Total	1,346	449	287	3,079	412	395
Other Western Hemisphere	576	67	39	643	50	78
Europe:						
EEC	17	NA	NA	2,248	−129	29
Non-EEC:						
United Kingdom	2	(3)	(3)	1,563	−59	2
Other	52	10	NA	998	−8	4
Total Europe	72	10	5	4,805	−196	35
Africa:						
Republic of South Africa	84	36	29	158	NA	NA
Other	343	67	39	1,598	557	558
Total	427	103	68	1,756	NA	NA
Near East	3	(3)	--------	1,654	1,133	1,181
Far East	53	NA	NA	1,303	NA	94
Oceania:						
Australia	395	50	37	NA	NA	NA
Other	−1	(3)	(3)	NA	NA	NA
Total	394	50	37	678	NA	NA
International shipping	--------	--------	--------	1,708	132	137
Grand total [4]	5,635	844	664	19,985	2,494	2,635

[p] Preliminary. [r] Revised. NA Not available.
[1] Sum of U.S. share in net earnings of subsidiary and branch profits.
[2] Sum of interest, dividends and branch profits.
[3] Less than ½ unit.
[4] Detail may not add to totals shown because of independent rounding and exclusion of certain items of detail that are not releasable.

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Table 17.—World merchant fleet distribution, by type [1]

	1966	1967	1968	1969
Number of vessels:				
Tankers	3,610	3,740	3,895	4,071
Bulk carriers	2,039	2,368	2,609	2,748
Freighters	10,908	10,963	11,052	10,980
Other	1,746	1,729	1,805	1,771
Total	18,303	18,800	19,361	19,570
Gross tonnage:				
Tankers thousand tons	58,999	65,804	71,641	79,457
Bulk carriers do	22,350	31,644	37,596	41,746
Freighters do	61,025	61,821	62,559	62,960
Other do	12,674	12,253	12,446	12,084
Total do	155,048	171,522	184,242	196,247
Deadweight tonnage:				
Tankers do	98,022	105,542	117,135	133,421
Bulk carriers do	34,177	49,638	59,926	67,638
Freighters do	85,852	86,107	86,702	87,250
Other do	9,363	9,116	9,447	9,214
Total do	222,414	250,403	273,210	297,523

[1] Maritime Administration classification. Tankers include whaling tankers. Vessels shown here as "Other" include: Combination passenger and cargo, combination passenger and refrigerated cargo, and refrigerated freighters. Contribution of these vessels to mineral commodity trade is regarded as unimportant. Data are as of December 31 of year indicated.

Table 18.—Distribution of world oil tanker tonnage by size groups [1]

Size group (deadweight tons)	1966		1969			
			In service		New building in progress or on order at yearend	
	Million deadweight tons	Percent of total	Million deadweight tons	Percent of total	Million deadweight tons [2]	Percent of total
Under 25,000	30.0	30.2	28.9	21.4	1.6	2.7
25,000–45,000	25.3	25.5	26.7	19.7	1.6	2.7
45,000–65,000	21.2	21.3	22.0	16.3	.3	.5
65,000–85,000	12.7	12.8	16.5	12.2	.9	1.5
85,000–105,000	6.6	6.6	14.2	10.5	1.5	2.5
105,000–125,000	2.5	2.5	5.6	4.1	1.7	2.9
125,000–145,000	----	----	1.7	1.2	1.9	3.2
145,000–165,000	----	----	2.0	1.5	.9	1.5
165,000–185,000	1.1	1.1	1.2	1.0	----	----
185,000–205,000	----	----	3.1	2.3	2.0	3.4
205,000 and over	----	----	13.3	9.8	46.8	79.1
Total	[3] 99.4	100.0	135.2	100.0	59.2	100.0

[1] Includes vessels 2,000 deadweight tons and over.
[2] Excludes 13.6 million deadweight tons in bulk (multiple-cargo) carriers.
[3] Data differ slightly from total given in table 17 owing to difference in source.

Source: British Petroleum Co. Ltd. BP Statistical Review of the World Oil Industry. Baynard Press, London, 1966, p. 15; 1969, p. 14.

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Table 19.—Commercial ocean traffic through the Panama Canal in terms of number of transits and total cargo moved, by type of vessel

	Ore ships	Tankers	Combination carriers	Container cargo ships	Dry bulk carriers	General cargo ships	Other	Total
1968								
Number of transits:								
In ballast:								
Atlantic to Pacific	--	27	3	--------	6	163	550	749
Pacific to Atlantic	1	871	19	--------	284	236	95	1,506
Total	1	898	22	--------	290	399	645	2,255
Laden:								
Atlantic to Pacific	10	976	67	30	865	3,377	539	5,864
Pacific to Atlantic	6	156	25	25	629	3,071	1,168	5,080
Total	16	1,132	92	55	1,494	6,448	1,707	10,944
In ballast and laden:								
Atlantic to Pacific	10	1,003	70	30	871	3,540	1,089	6,613
Pacific to Atlantic	7	1,027	44	25	913	3,307	1,268	6,586
Grand total	17	2,030	114	55	1,784	6,847	2,352	18,199
Cargo moved (thousand metric tons):								
Atlantic to Pacific	266	15,849	2,668	137	21,907	20,657	861	62,345
Pacific to Atlantic	170	2,381	532	130	12,531	17,121	2,890	35,755
Total	436	18,230	3,200	267	34,438	37,778	3,751	98,100
1969								
Number of transits:								
In ballast:								
Atlantic to Pacific	2	27	7	--------	20	142	602	800
Pacific to Atlantic	2	898	11	--------	277	141	118	1,447
Total	4	925	18	--------	297	283	720	2,247
Laden:								
Atlantic to Pacific	11	993	75	32	1,075	3,029	522	5,737
Pacific to Atlantic	6	163	16	29	753	3,036	1,163	5,166
Total	17	1,156	91	61	1,828	6,065	1,685	10,903
In ballast and laden:								
Atlantic to Pacific	18	1,020	82	32	1,095	3,171	1,124	6,537
Pacific to Atlantic	8	1,061	27	29	1,030	3,177	1,281	6,613
Grand total	21	2,081	109	61	2,125	6,348	2,405	18,150

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Cargo moved (thousand metric tons):								
Atlantic to Pacific	312	16,681	3,258	129	27,009	17,464	937	65,790
Pacific to Atlantic	128	1,942	392	132	14,855	17,390	2,889	37,228
Total	440	18,623	3,650	261	41,864	34,854	3,826	103,018

Source: Panama Canal Company. Annual Reports for 1968 and 1969.

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Table 20.—Movement of mineral commodities through the Panama Canal, by commodity type and direction of movement

(Thousand metric tons)

Commodity	Atlantic to Pacific			Pacific to Atlantic			Total		
	1967	1968	1969	1967	1968	1969	1967	1968	1969
METALS									
Aluminum:									
Bauxite and alumina	1,138	1,372	1,243	138	416	132	1,276	1,788	1,375
Metal, except scrap	60	44	101	68	69	74	128	113	175
Chromium, chromite	12	59	14	177	119	155	189	178	169
Copper:									
Ore and concentrate	76	124	68	173	251	170	249	375	238
Metal, except scrap	22	25	30	732	684	701	754	709	731
Iron and steel:									
Iron ore	49	34	179	4,019	3,127	2,924	4,068	3,161	3,103
Iron and steel:									
Pig iron, steel ingots, and other crude forms except scrap	470	2,117	1,248	50	49	18	520	2,166	1,266
Semimanufactures (excluding tinplate)	2,049	1,869	1,881	3,286	4,216	5,510	5,335	6,085	7,391
Lead:									
Ore and concentrate	23	13	19	44	127	128	67	140	147
Metal, except scrap	5	13	3	208	208	147	213	216	150
Manganese, ore and concentrate	59	77	109	36	48	133	95	125	242
Tin:									
Ore and concentrate	1	-------	1	103	77	89	104	77	90
Metal (including tinplate)	152	142	145	74	90	94	226	232	239
Zinc:									
Ore and concentrate	74	129	150	178	215	153	252	344	303
Metal, except scrap	7	8	19	154	129	148	161	137	167
Other and unclassified:									
Ore and concentrate	55	47	91	423	403	533	478	450	624
Metal, except scrap	20	30	35	58	78	102	78	108	137
Metal scrap, all metals	3,496	2,845	2,688	12	25	33	3,508	2,870	2,716
NONMETALS									
Asbestos	177	182	193	23	29	46	200	211	239
Borax	1	6	9	294	360	340	295	366	349
Cement	281	106	116	40	46	13	321	152	129
Clays and clay products:									
Fire clay and kaolin	143	185	230	5	15	21	148	200	251
Brick and tile	30	40	59	61	103	136	91	143	195
Diatomaceous earth	7	6	8	64	66	55	71	72	63
Fertilizer materials:									
Nitrogenous:									
Ammonium compounds	187	248	390	3	5	16	190	253	406
Sodium nitrate	12	17	21	607	449	392	619	466	413
Phosphatic	3,525	4,296	4,737	125	104	94	3,650	4,400	4,831
Potassic	85	127	155	446	654	721	531	781	876
Unclassified	488	565	636	16	13	43	499	578	679
Sodium compounds:									
Salt	200	278	196	83	320	376	283	598	572
Other	292	99	99	16	17	60	308	116	159
Sulfur	648	466	198	174	198	182	822	664	375

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MINERAL FUELS AND RELATED MATERIALS									
Coal and coke	9,223	13,354	16,522	283	52	30	9,506	13,406	16,552
Petrochemicals	249	368	479	135	154	126	384	522	605
Petroleum:									
Crude	5,167	5,406	6,092	269	661	581	5,436	6,067	6,673
Refinery products	11,151	10,953	10,168	484	1,022	1,065	11,635	11,975	11,233
Total	39,629	45,650	48,322	13,061	14,594	15,541	52,690	60,244	63,863

Table 21.—Indexes of ocean freight rates

(1963 = 100)

	London tanker brokers panel	Trip charter									Time charter	
		West Germany		Netherlands (general)	Norway		United Kingdom				Norway (dry cargo)	United Kingdom (dry cargo)
		Dry cargo	Tankers		Dry cargo	Tankers	General	Coal trade	Ore trade	Fertilizer trade		
1966	89	100	84	100	97	84	104	88	94	128	113	126
1967	109	102	154	92	104	155	111	95	85	186	113	124
1968: [1]												
First quarter	107	100	150	[2] 94	104	129	121	94	NA	215	120	136
Second quarter	121	98	200	NA	102	177	116	92	NA	213	116	139
Third quarter	102	98	145	NA	101	125	109	90	NA	197	117	128
Fourth quarter	106	104	172	NA	102	152	116	87	NA	199	113	118
Annual average	108	100	158	NA	102	142	114	92	NA	206	118	132
1969: [1]												
First quarter	91	92	111	NA	93	103	108	86	NA	190	112	133
Second quarter	83	97	102	NA	93	98	100	86	NA	140	110	141
Third quarter	90	101	136	NA	93	122	100	84	NA	168	111	127
Fourth quarter	NA	111	201	NA	101	186	109	101	NA	184	120	136
Annual average	NA	100	127	NA	94	119	108	90	NA	172	114	131

NA Not available.
[1] Except as noted, quarterly figures are for the last month in the quarter.
[2] Actual quarterly average.

Source: United Nations. Bulletin of Monthly Statistics. September 1969, p. xvi; and September 1970, p. xvi.

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Table 22.—Nonferrous metal prices in the United States

(Average, cents per pound except where otherwise noted)

Year and month	Aluminum [1]	Copper [2]	Lead [3]	Zinc [4]	Tin [5]	Silver [6]
1967	24.978	[7] 38.226	14.183	13.843	153.434	154.968
1968	25.583	[8] 41.847	13.012	13.500	148.151	214.460
1969:						
January	26.455	43.498	13.209	13.841	162.750	197.886
February	27.000	43.831	13.800	14.000	165.289	183.972
March	27.000	44.390	13.800	14.000	155.714	182.571
April	27.000	44.552	14.205	14.004	156.845	177.810
May	27.000	45.488	14.300	14.500	156.690	176.095
June	27.000	46.024	14.662	14.500	159.024	164.548
July	27.000	46.047	15.247	14.500	162.012	161.833
August	27.000	47.925	15.300	14.500	166.036	165.262
September	27.000	51.359	15.300	14.857	165.655	178.548
October	27.652	52.082	15.300	15.500	166.587	187.250
November	28.000	52.119	15.388	15.500	175.971	192.313
December	28.000	52.498	15.826	15.500	181.405	180.174
Annual average	27.176	47.534	14.695	14.600	164.498	179.067

[1] Unalloyed ingot, 99.5 percent, delivered United States.
[2] Electrolytic copper, domestic refineries, Atlantic seaboard.
[3] Refined lead, St. Louis.
[4] Prime Western slab, f.o.b., East St. Louis.
[5] Straits tin, New York.
[6] Cents per troy ounce, 0.999 fine, New York.
[7] Based on the first 8 months of 1967.
[8] Based on the last 9 months of 1968.

Source: Yearbook of the American Bureau of Metal Statistics. Annual Issue for the year 1969. New York, 1970, 148 pp.

Table 23.—Nonferrous metal prices in the United Kingdom

(Average, £ per long ton unless otherwise noted) [1]

Year and month	Aluminum [2]	Copper [3]	Lead [4]	Zinc [5]	Tin [6]	Silver [7]
1967	199.628	417.338	83.763	100.429	1,222.458	141.977
1968	233.981	523.975	101.796	111.175	1,323.863	219.529
1969:						
January	248.175	531.546	107.508	118.954	1,367.342	201.011
February	247.333	544.125	109.333	118.100	1,374.225	186.975
March	247.333	541.213	110.533	114.683	1,373.429	184.881
April	247.333	587.650	118.492	115.396	1,399.250	180.513
May	247.333	589.500	117.717	117.942	1,421.333	178.560
June	247.333	627.808	120.788	119.013	1,431.263	166.429
July	247.333	615.500	131.529	120.008	1,456.542	163.935
August	247.333	680.167	133.683	124.275	1,469.858	166.881
September	247.333	668.475	127.954	126.638	1,469.308	179.917
October	250.174	658.129	124.267	126.429	1,497.217	186.804
November	256.666	690.625	133.521	130.904	1,542.675	192.875
December	256.666	719.642	141.288	131.229	1,616.975	180.512
Annual average	248.449	621.254	122.700	121.150	1,451.838	180.774

[1] London Metal Exchange, average settlement prices.
[2] Ingots, 99.5 percent.
[3] Electrolytic wirebars.
[4] Refined pig lead, 99.97 percent.
[5] Virgin zinc, 98 percent.
[6] Standard tin.
[7] Pence per troy ounce, 0.999 fine.

Source: Yearbook of the American Bureau of Metal Statistics. Annual Issue for the year 1969. New York, 1970, 148 pp.

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Table 24.—Nonferrous metal prices in Canada

(Average, Canadian cents per pound unless otherwise noted)

Year and month	Aluminum [1]	Copper [2]	Lead [3]	Zinc [3]	Silver [4]
1967	26.48	47.589	14.000	13.870	172.030
1968	27.07	48.020	13.443	13.500	230.557
1969:					
January	28.05	45.860	13.909	13.795	212.277
February	28.50	45.500	14.500	14.000	197.639
March	28.50	45.500	14.500	14.000	196.567
April	28.50	45.500	14.881	14.000	191.352
May	28.50	49.140	15.000	14.500	189.648
June	28.50	50.000	15.338	14.500	177.605
July	28.50	50.000	15.500	14.500	175.000
August	28.50	51.100	15.500	14.500	178.176
September	28.50	56.280	15.500	15.405	192.510
October	28.91	57.000	15.500	15.500	201.840
November	29.50	57.000	15.600	15.500	206.911
December	29.50	57.000	16.238	15.500	194.109
Annual average	28.70	50.794	15.163	14.642	192.803

[1] Ingot 99.5 percent.
[2] Electrolytic ingot, prompt delivery at Toronto.
[3] Producers' prices, carload quantities, communicated by Cominco, Ltd., pig lead and prime western zinc.
[4] Canadian cents per troy ounce, Cominco, Ltd., price.

Source: Yearbook of the American Bureau of Metal Statistics. Annual Issue for the year 1969. New York, 1970, 148 pp.

Table 25.—Mineral commodity export price indexes

(1963 = 100)

Year and quarter	Metal ores	Fuels	All crude minerals
1967	109	101	108
1968	108	100	102
1969:			
First quarter	112	101	108
Second quarter	117	100	104
Third quarter	118	100	103
Fourth quarter	116	101	104
Annual average	114	100	104

Source: United Nations. Monthly Bulletin of Statistics. New York, June 1970, p. xix.

Table 26.—Analysis of export price indexes

(1963 = 100)

Year and quarter	Developed areas		Less developed areas	
	Total minerals	Non-ferrous base metals	Total minerals	Non-ferrous base metals
1967	105	135	102	156
1968	104	142	102	165
1969:				
First quarter	106	148	102	169
Second quarter	106	155	103	182
Third quarter	106	163	102	195
Fourth quarter	109	169	103	203
Annual average	107	158	103	187

Source: United Nations. Monthly Bulletin of Statistics. New York, June 1970, p. xix.

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Table 27.—Leading world producers of bauxite [1]

(Gross weight, thousand metric tons)

Country	1967	1968	1969 [p]
Jamaica	9,268	8,525	10,499
Australia	4,244	4,961	7,917
Surinam	5,466	5,660	5,538
U.S.S.R.[e] [2]	5,000	5,000	5,200
Guyana	3,381	3,722	[e] 3,760
France	2,813	2,713	2,773
Guinea	1,639	2,118	2,459
Yugoslavia	2,131	2,072	2,128
Greece	1,659	1,750	1,940
Hungary	1,650	1,959	1,932
United States	1,680	1,691	1,872
Total	[r] 38,931	40,171	46,018
All others	[r] 5,590	5,704	6,357
Grand total	[r] 44,521	45,875	52,375

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.
[2] Excludes nepheline concentrates and alunite ore.

Table 28.—Leading world producers of aluminum [1]

(Thousand metric tons)

Country	1967	1968	1969 [p]
United States	[r] 2,965	2,953	3,441
U.S.S.R.[e]	965	1,000	1,100
Canada	885	888	996
Japan	382	482	569
Norway	361	468	502
France	361	366	372
Germany, West	253	257	263
Italy	128	142	144
India	96	120	131
Australia	93	97	126
Total	[r] 6,489	6,773	7,644
All others	1,081	1,280	1,426
Grand total	[r] 7,570	8,053	9,070

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.

Table 29.—Leading world producers of mine copper [1]

(Copper content of ore, recoverable where indicated, thousand metric tons)

Country	1967	1968	1969 [p]
United States [2]	866	1,148	1,401
U.S.S.R.[e]	800	850	900
Zambia	662	665	748
Chile	663	667	697
Canada [2]	[r] 556	552	500
Congo (Kinshasa)	319	325	362
Peru	[r] 193	213	206
South Africa, Republic of	150	146	148
Philippines	85	110	131
Australia	[r] 93	109	130
Total	[r] 4,387	4,785	5,223
All others	[r] 651	703	776
Grand total	[r] 5,038	5,488	5,999

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.
[2] Recoverable.

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Table 30.—Leading world producers of iron ore, iron ore concentrates, and iron ore agglomerates [1]

(Thousand metric tons)

Country	1967	1968	1969 [p]
U.S.S.R.	[r] 186,246	176,616	186,000
United States	85,530	87,248	90,674
France	49,220	55,238	55,400
Canada	38,390	48,205	40,643
China, mainland [e]	28,000	38,000	40,000
Australia	17,158	26,394	39,096
Sweden	[r] 28,337	32,420	33,185
Brazil	22,298	25,123	[e] 33,000
India (including Goa)	26,157	27,438	28,304
Liberia	18,224	19,571	22,866
Venezuela	[r] 17,005	16,190	19,724
United Kingdom	12,944	13,935	12,298
Chile	10,783	11,916	11,637
Total	[r] 540,292	578,289	612,827
All others	82,417	106,957	111,022
Grand total	[r] 622,709	685,246	728,849

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.

Table 31.—Leading world producers of steel ingots and castings [1]

(Thousand metric tons)

Country	1967	1968	1969 [p]
United States	115,406	119,260	128,185
U.S.S.R.	102,224	106,537	110,000
Japan	62,154	66,892	82,948
Germany, West	[r] 36,744	41,159	45,316
United Kingdom	24,276	26,276	26,846
France	19,655	20,410	22,511
Italy	15,890	16,964	16,428
China, mainland [e]	11,000	15,000	16,000
Belgium	9,716	11,568	12,837
Poland	10,454	11,007	11,291
Czechoslovakia	10,002	10,555	10,819
Canada	8,795	10,207	9,350
Total	[r] 426,316	455,835	492,531
All others	67,264	73,248	81,167
Grand total	[r] 493,580	529,083	573,698

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.

Table 32.—Leading world producers of mine lead [1]

(Lead content of ore, recoverable where indicated, thousand metric tons)

Country	1967	1968	1969 [p]
United States [2]	288	326	462
Australia	[r] 382	389	445
U.S.S.R. [e]	400	420	440
Canada	308	327	300
Mexico	164	174	171
Peru [2]	[r] 160	155	163
Yugoslavia	108	112	123
China, mainland [e]	90	100	100
Total	[r] 1,900	2,003	2,204
All others	[r] 960	989	1,008
Grand total	[r] 2,860	2,992	3,212

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.
[2] Recoverable.

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Table 33.—Leading world producers of manganese ore [1]

(Thousand metric tons)

Country	1967	1968	1969 [p]
U.S.S.R.	7,175	6,564	[e] 7,000
South Africa, Republic of	1,817	1,972	2,204
Brazil	[r] 1,132	2,097	2,149
India (including Goa)	1,589	1,602	1,605
Gabon	1,147	1,254	1,363
China, mainland [e]	700	900	1,000
Australia	[r] 569	746	922
Ghana	498	413	350
Congo (Kinshasa) [e]	272	322	311
Japan	339	312	302
Total	[r] 15,238	16,182	17,206
All others	1,702	1,227	1,053
Grand total	[r] 16,940	17,409	18,259

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.

Table 34.—Leading world producers of mine tin [1]

(Tin content of ore, long tons)

Country	1967	1968	1969 [p]
Malaysia	72,121	75,069	72,167
Bolivia	26,890	28,945	29,489
U.S.S.R. [2]	25,000	26,000	27,000
Thailand	[r] 22,490	23,678	20,786
China, mainland [2]	20,000	20,000	20,000
Indonesia	18,597	16,563	17,146
Nigeria	9,340	9,644	8,606
Australia	5,586	6,650	7,878
Total	[r] 195,024	206,549	203,067
All others	19,209	21,386	20,542
Grand total	[r] 214,233	227,935	223,609

[p] Preliminary. [r] Revised.
[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.
[2] Estimated smelter production.

Table 35.—Leading world producers of mine zinc [1]

(Zinc content of ore, recoverable where indicated, thousand metric tons)

Country	1967	1968	1969 [p]
Canada	1,133	1,155	1,194
U.S.S.R. [e] [2]	[r] 540	575	610
Australia	[r] 407	422	505
United States	498	480	502
Peru	305	291	315
Japan	263	264	270
Mexico	241	240	253
Poland	157	165	[e] 167
Italy	125	140	133
Congo (Kinshasa)	122	127	128
Korea, North [e]	115	120	125
Germany, West	[r] 106	110	111
Ireland	36	53	105
China, mainland [e]	90	100	100
Total	[r] 4,138	4,242	4,518
All others	699	759	803
Grand total	[r] 4,837	5,001	5,321

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.
[2] Recoverable.

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Table 36.—Leading world producers of hydraulic cement [1]

(Thousand metric tons)

Country	1967	1968	1969 [p]
U.S.S.R.	[r] 84,809	87,512	89,800
United States (including Puerto Rico)	65,807	70,314	71,101
Japan	42,998	48,009	51,386
Germany, West	[r] 31,711	33,433	35,008
Italy	26,272	29,536	31,310
France	24,400	25,600	27,543
United Kingdom	[r] 17,581	17,873	17,420
Spain (includes Canary Islands)	[r] 13,477	15,100	16,013
India	11,700	11,940	13,260
Poland	11,138	11,600	11,880
China, mainland [e]	8,000	9,000	10,000
Canada	7,253	7,408	7,751
Germany, East	7,182	7,551	[e] 7,600
Rumania	6,338	7,026	7,515
Brazil	6,405	7,281	7,189
Total	[r] 365,066	389,183	404,726
All others	114,890	124,116	133,798
Grand total	[r] 479,956	513,299	538,524

[e] Estimate. [p] Preliminary. [r] Revised.

[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.

Table 37.—Leading world producers of phosphate rock [1]

(Thousand metric tons)

Country	1967	1968	1969 [p]
United States	36,079	37,422	34,224
U.S.S.R. [e] [2]	16,300	17,700	19,250
Morocco	9,945	10,512	10,662
Tunisia	2,810	3,444	3,200
Nauru Island [3]	1,798	2,254	2,198
Total	66,932	71,332	69,534
All others	[r] 11,005	12,684	12,363
Grand total	[r] 77,937	84,016	81,897

[e] Estimate. [p] Preliminary. [r] Revised.

[1] Includes output of all major crude mineral sources of phosphate, including apatite, guano, and similar materials as well as regular phosphate rock. Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.

[2] Includes material described as sedimentary rock in Soviet sources.

[3] Exports.

Table 38.—Leading world producers of marketable potash [1]

(Thousand metric tons K_2O equivalent)

Country	1967	1968	1969 [p]
U.S.S.R.	2,868	3,120	[e] 3,180
Canada	2,162	2,647	2,854
Germany, West	[r] 2,460	2,561	2,626
United States	[r] 3,012	2,993	2,544
Germany, East	2,206	2,293	2,300
France	[r] 1,938	1,857	[e] 1,938
Total	[r] 14,646	15,471	15,442
All others	[r] 1,116	1,251	1,250
Grand total	[r] 15,762	16,722	16,692

[e] Estimate. [p] Preliminary. [r] Revised.

[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.

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Table 39.—Leading world producers of pyrite [1]

(Gross weight, thousand metric tons)

Country	1967	1968	1969 p
Japan	4,528	4,472	4,453
U.S.S.R.•	3,500	3,500	3,500
Spain	2,291	2,403	2,475
China, mainland •	1,500	1,500	1,800
Italy	1,411	1,406	1,475
South Africa, Republic of	r 869	704	837
Cyprus	862	874	826
Finland	712	774	• 803
Norway	637	693	758
Germany, West	556	616	641
Portugal	528	561	531
Korea, North •	500	500	500
Sweden	483	474	495
Czechoslovakia	376	380	• 400
Total	r 18,753	18,857	19,494
All others	3,758	3,613	2,620
Grand total	r 22,511	22,470	22,114

• Estimate. p Preliminary. r Revised.

[1] Includes cupreous pyrites. Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.

Table 40.—Leading world producers of elemental sulfur [1]

(Thousand metric tons)

Country	1967	1968	1969 p
United States	r 8,415	8,955	8,079
Canada (sales)	2,267	2,341	2,708
Poland	722	1,316	• 1,950
France	1,665	1,608	1,732
Mexico	r 1,894	1,685	1,716
U.S.S.R.•	1,500	1,500	1,600
Japan	316	336	346
China, mainland •	250	250	250
Germany, West	105	127	129
Germany, East	123	119	• 120
Total	r 17,257	18,237	18,630
All others	r 657	688	724
Grand total	r 17,914	18,925	19,354
Distribution by type:			
Frasch	r 9,179	10,015	9,588
From sulfur ores	r 2,219	2,232	2,418
Other elemental recovered	r 6,516	6,678	7,348

• Estimate. p Preliminary. r Revised.

[1] Includes Frasch process sulfur, sulfur from sulfur ores, and byproduct sulfur from other ores, natural gas, and oil industry operations, but excludes sulfur contained in sulfuric acid manufactured directly from ores and other sources without being first reduced to elemental sulfur. Moreover, insofar as possible, elemental sulfur derived from pyrite is also excluded. Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.

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Table 41.—Leading world producers of coal (all grades) [1]

(Million metric tons)

Country	1967			1968			1969 [p]		
	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total
U.S.S.R.[2]	144	451	595	138	456	594	• 140	• 468	• 608
United States	4	508	512	4	501	505	5	513	518
China, mainland •	(3)	225	225	4	296	300	4	326	330
Germany, East	242	2	244	247	• 2	249	• 247	• 2	249
Germany, West	97	[4] 113	210	102	[4] 112	214	108	[4] 112	220
Poland	24	124	148	27	129	156	31	134	165
United Kingdom	--------	175	175	--------	167	167	--------	153	153
Czechoslovakia	71	26	97	75	26	101	80	27	107
India	3	68	71	4	71	75	4	73	77
Australia	24	35	59	23	41	64	23	46	69
South Africa, Republic of	--------	49	49	--------	52	52	--------	53	53
Japan	(5)	47	47	(5)	47	47	(5)	45	45
France	3	48	51	3	42	45	3	41	44
Bulgaria	26	(5)	26	29	(5)	29	(5)	29	29
Yugoslavia	26	1	27	26	1	27	25	1	26
Hungary	23	4	27	23	4	27	22	4	26
Korea, North •	(3)	21	21	(3)	23	23	(3)	25	25
Total	687	1,897	2,584	705	1,970	2,675	692	2,052	2,744
All others	32	101	133	31	99	130	64	69	133
Grand total	719	1,998	2,717	736	2,069	2,805	756	2,121	2,877

• Estimate. [p] Preliminary.

[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.

[2] Excludes production from U.S.S.R. controlled portion of Svalbard (Spitzbergen).

[3] Output small, included under bituminous and anthracite.

[4] Includes pitch coal.

[5] Less than ½ unit.

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Table 42.—Leading world producers of marketed natural gas [1]

(Billion cubic feet)

Country	1967	1968	1969 [p]
United States	18,171	19,322	20,698
U.S.S.R.	5,601	6,039	6,380
Canada	1,472	1,692	1,985
Rumania	560	775	851
Netherlands	254	514	778
Italy	324	368	417
Venezuela	293	301	314
Germany, West	148	204	289
Mexico	276	285	283
France	196	201	230
Total	27,295	29,701	32,220
All others	1,114	1,387	1,795
Grand total	28,409	31,088	34,015

[p] Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.

Table 43.—Leading world producers of crude oil [1]

(Million 42-gallon barrels)

Country	1967	1968	1969 [p]
United States	3,216	3,329	3,372
U.S.S.R.	2,100	2,252	2,395
Venezuela	1,293	1,319	1,312
Iran	948	1,039	1,232
Libya	637	949	1,135
Saudi Arabia	948	1,036	1,092
Kuwait	837	886	940
Iraq	446	550	554
Canada	351	379	407
Algeria	[r] 298	325	338
Indonesia	186	220	271
Trucial States	139	182	219
Nigeria	117	52	197
Kuwait-Saudi Arabia Neutral Zone	151	157	163
Mexico	133	142	150
China, mainland [e]	80	110	146
Argentina	115	125	130
Qatar	118	124	130
Muscat and Oman	23	88	120
Total	[r] 12,136	13,264	14,303
All others	753	840	916
Grand total	[r] 12,889	14,104	15,219

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Includes additions and revisions to data appearing elsewhere in the 1969 Minerals Yearbook (all volumes). Compiled Sept. 30, 1970.

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Table 44.—Major world trade in bauxite and alumina

(Thousand metric tons)

Source countries	1968 production by source country [2]	1968 export by source country [2]	Recipient countries [3]											
			United States	Canada	Austria	France	West Germany	Italy	Norway	Sweden	United Kingdom	U.S.S.R.	Japan	Selected other [4]
Bauxite:														
Australia	4,961	NA	-----	22	-----	212	400	-----	-----	-----	-----	-----	916	-----
Dominican Republic	994	1,207	967	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
France	2,713	157	-----	-----	-----	XX	90	-----	-----	-----	70	-----	-----	1
Ghana	285	241	-----	-----	-----	-----	43	-----	-----	-----	210	-----	-----	-----
Greece	1,750	1,190	32	-----	-----	62	327	-----	37	80	98	457	11	75
Guinea	2,118	549	15	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Guyana	3,722	2,403	576	1,599	-----	37	50	e 41	-----	6	14	-----	35	47
Haiti	446	469	469	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Hungary	1,959	665	-----	-----	7	-----	80	-----	-----	-----	-----	-----	-----	-----
India	936	99	-----	-----	-----	-----	9	59	-----	-----	24	-----	9	-----
Indonesia	879	848	-----	-----	-----	-----	6	82	-----	-----	-----	-----	757	-----
Jamaica	8,525	6,312	7,509	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Malaysia	799	789	-----	46	-----	-----	-----	-----	-----	-----	-----	-----	687	-----
Sierra Leone	421	470	-----	-----	-----	-----	327	137	-----	-----	-----	-----	-----	-----
Surinam	5,660	3,720	2,942	607	15	23	45	-----	-----	-----	14	-----	21	-----
United States	1,691	7	XX	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Yugoslavia	2,072	1,868	-----	-----	-----	-----	600	253	-----	-----	10	721	-----	-----
Other and not specified	5,944	NA	108	-----	3	1	1	14	-----	5	2	-----	14	13
Total	45,875	NA	12,618	2,277	25	335	1,978	586	37	41	442	1,178	2,450	136
Alumina:														
Australia	1,309	NA	633	84	-----	-----	-----	-----	28	-----	-----	-----	(5)	-----
Canada	e 1,000	NA	144	XX	-----	1	-----	1	-----	-----	-----	-----	-----	-----
France	952	234	(5)	-----	-----	XX	1	26	3	(5)	1	-----	(5)	169
Germany, West	742	135	1	(5)	79	1	XX	2	-----	5	3	-----	(5)	28
Greece	225	73	-----	-----	-----	-----	-----	14	-----	-----	-----	28	-----	-----
Guinea	531	531	-----	16	47	5	42	-----	136	-----	-----	-----	-----	138
Guyana	270	248	22	(5)	-----	-----	-----	-----	69	23	-----	-----	-----	35
Hungary	381	361	-----	-----	30	-----	-----	-----	-----	-----	-----	148	-----	6
Jamaica	922	922	115	111	-----	16	-----	-----	274	109	-----	-----	-----	-----
Japan	826	27	10	-----	-----	-----	(5)	-----	-----	-----	(5)	-----	XX	3
Surinam	892	680	430	375	-----	-----	3	-----	179	-----	-----	-----	-----	101
United States	5,842	803	XX	186	-----	7	3	3	236	7	1	194	1	8
Yugoslavia	118	21	-----	(5)	8	-----	-----	-----	-----	-----	-----	-----	-----	-----
Other and not specified	NA	NA	1	-----	9	1	1	2	7	-----	1	18	1	10
Total	NA	NA	1,356	772	173	31	50	48	932	144	6	388	2	498

e Estimate. NA Not available. XX Not applicable.

[1] Data presented are compiled from import statistics for countries listed as recipient countries and, as such, are incomplete, but are believed to account for the overwhelming share of total world movements of bauxite and alumina.

[2] As reported in latest country chapter of Volume IV, Minerals Yearbook. Data on bauxite production is on dry equivalent basis for a number of countries, and as such may be reported on a different basis from bauxite exports, which almost universally are on a gross weight basis and which were obtained from the Statistical Office of the United Nations. Data on alumina production are generally for output prior to calcination, while data on alumina exports, also from the Statistical Office of the United Nations, include aluminum hydroxide and thus may not be exactly comparable.

[3] Countries selected are most of the world's significant aluminum producers that depend upon imports of bauxite and/or alumina for a significant share of their raw material requirements, plus a few minor countries for which data were readily available. Data are from the Statistical Office of the United Nations except for U.S.S.R. figures, which were obtained from official Soviet sources.

[4] Countries included are as follows: Bauxite—Belgium, Luxembourg, Netherlands, Spain, and Yugoslavia; alumina—Australia, Belgium, Denmark, Finland, Greece, Luxembourg, Netherlands, New Zealand, Portugal, Spain, Switzerland, and Turkey.

[5] Less than ½ unit.

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Table 45.—Major world trade [1] in unrefined and refined unwrought copper in 1968

(Thousand metric tons)

Source countries	Destinations							
	Belgium-Luxembourg	Brazil	Czechoslovakia	France	Germany		Italy	Japan
					East	West		
Belgium-Luxembourg	XX	2	4	89	---	58	15	---
Canada	1	1	---	10	---	10	1	5
Chile	10	8	---	34	---	111	50	41
Congo, Republic of the (Kinshasa) [2]	219	---	---	32	---	4	87	7
Germany, West	8	6	1	11	---	XX	---	---
Peru	25	---	---	---	---	17	(3)	8
U.S.S.R.	---	---	32	---	44	5	---	---
United Kingdom	2	(3)	1	3	---	10	1	---
United States	16	28	---	28	(3)	33	35	17
Zambia	---	7	2	56	---	88	65	142
Other and unspecified [4]	17	1	---	6	3	46	5	16
Total	298	53	40	269	47	382	209	236

Source countries	Destinations							
	Netherlands	Spain	Sweden	Switzerland	United Kingdom	United States	Other and unspecified [5]	Total
Belgium-Luxembourg	56	7	18	13	7	35	11	310
Canada	3	1	(3)	1	94	122	2	251
Chile	1	8	34	3	111	161	30	602
Congo, Republic of the (Kinshasa) [2]	5	---	---	---	5	2	3	314
Germany, West	11	5	(3)	6	20	32	43	143
Peru	4	2	---	---	(3)	107	7	170
U.S.S.R.	4	---	---	---	1	---	23	109
United Kingdom	10	3	1	---	XX	16	10	57
United States	9	3	4	2	36	XX	31	242
Zambia	6	7	18	8	193	11	38	641
Other and unspecified [4]	34	7	8	4	17	21	27	207
Total	143	43	73	37	484	507	225	3,046

XX Not applicable.

[1] Data are compiled chiefly from export statistics for countries listed as source countries in stub of table.

[2] Import statistics of listed trading partners.

[3] Less than ½ unit.

[4] Includes the following countries (total exports in thousand tons in parentheses following country name): Australia (24); Austria (4); Denmark (1); Finland (11); France (23); Italy (8); Japan (12); Netherlands (4); New Zealand (3); Norway (27); Sweden (28); Switzerland (4); Turkey (15); Yugoslavia (9).

[5] Countries in this group reported as destination for 10,000 tons of copper or more each include the following, in order of quantity (figures in parentheses are quantities reported, in thousand tons): India (30); Argentina (22); China, mainland (21); Austria (19); Hungary (16); Yugoslavia (14); Poland (13).

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Table 46.—Major world trade in iron ores, concentrates, and agglomerates (excluding roasted pyrite) [1]

(Thousand metric tons)

Source country	Recorded total 1968 export of source country [2]	Recorded imports of principal recipient countries [3]					
		Canada	United States	Belgium-Luxembourg	Czechoslovakia	France	West Germany
Algeria	3,268	------	------	372	------	112	55
Australia	16,338	------	134	354	------	244	562
Brazil	15,050	379	1,277	562	228	1,313	4,730
Canada	36,589	XX	26,761	162	------	------	2,101
Chile	10,497	------	1,464	15	------	------	314
France	18,271	------	------	13,830	------	XX	4,508
India	15,646	------	------	400	986	9	183
Liberia	18,918	78	2,989	1,109	------	1,174	6,979
Malaysia	5,188	------	------	------	------	------	------
Mauritania	7,487	------	------	1,208	------	1,346	1,305
Norway	2,741	------	366	31	------	17	1,569
Peru	8,532	------	939	------	------	295	46
Sierra Leone	2,150	------	------	127	------	------	982
South Africa, Republic of [4]	4,476	------	------	------	------	------	58
Sweden	28,775	------	235	8,059	241	284	12,889
U.S.S.R.	32,201	------	------	------	9,502	------	36
United States	5,978	2,335	XX	------	------	------	------
Venezuela	15,053	------	10,478	------	------	------	1,664
Other countries and origin unreported [5]	6,760	2	3	108	190	228	1,663
Total	253,918	2,794	44,646	26,337	11,147	5,017	39,644

Source country	Recorded imports of principal recipient countries [3]						
	Italy	Netherlands	Poland	United Kingdom	Other Europe [6]	Japan	Total of listed imports
Algeria	1,155	------	------	122	145	------	1,961
Australia	420	------	------	268	------	13,814	15,796
Brazil	1,248	709	132	565	1,185	2,177	14,505
Canada	1,272	429	------	3,347	18	1,977	36,067
Chile	------	------	------	------	------	8,707	10,500
France	------	------	------	73	------	------	18,411
India	52	165	272	11	947	12,772	15,797
Liberia	2,154	1,231	------	1,520	113	881	18,228
Malaysia	------	------	------	------	------	5,116	5,116
Mauritania	938	------	------	1,875	229	587	7,488
Norway	------	404	45	954	425	------	3,811
Peru	174	------	------	------	------	7,363	8,817
Sierra Leone	159	922	------	280	------	116	2,586
South Africa, Republic of [4]	------	------	------	------	------	4,898	4,956
Sweden	424	499	639	4,584	275	------	28,129
U.S.S.R.	550	------	10,008	1,499	4,871	808	27,274
United States	------	------	------	------	------	3,545	5,880
Venezuela	968	------	------	1,695	------	------	14,805
Other countries and origin unreported [5]	554	------	10	741	1,062	5,382	9,938
Total	10,068	4,359	11,106	17,534	9,270	68,143	250,065

See footnotes at end of table.

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Table 46.—Major world trade in iron ores, concentrates, and agglomerates (excluding roasted pyrite) [1]—Continued

XX Not applicable.

[1] Disparities between recorded exports of source countries and totals of recorded imports of recipient countries are due to (1) time lag between shipment and receipt, and (2) the fact that the latter totals are incomplete, covering only the nations listed in the column heads and in footnote 6.

[2] Source: Official trade returns of countries listed.

[3] Source: Statistical Office of the United Nations. 1968 World Trade Annual. V. I, Walker and Company, New York 1969, p. 136, except for data on Czechoslovakia, Poland, and East Germany, which are from official trade returns of the respective countries, and data on Rumania, in which case the total is from official Rumanian sources and the distribution by country of origin has been compiled from export statistics of partner countries.

[4] Includes Swaziland.

[5] Recorded 1968 export total is a total of the following countries (exports for each follow the country name in parentheses in thousand tons): Angola (442); Belgium-Luxembourg (17); Denmark (16); Finland (12); West Germany (18); Hong Kong (171); North Korea (535—Japanese imports only); South Korea (772); Morocco (657); Netherlands (3); New Caledonia (198); Philippines (1,516); Poland (7); Spain (1,170); Sudan (10); Thailand (402); Tunisia (654); Yugoslavia (97); Turkey (63). Recorded imports of principal recipient countries include receipts from the foregoing list of countries as well as receipts credited to the following countries for which either (1) no iron ore export was recorded in 1968 trade returns, or (2) trade returns for 1968 were not available: Bahrain; China (mainland), Greece, Iran, Mozambique, Southern Yemen, and United Arab Republic.

[6] Includes the following countries with recorded total imports as indicated in parentheses in thousand tons: Austria (1,375); Finland (628); East Germany (1,424); Greece (369); Norway (14); Portugal (102); Rumania (4,546); Spain (594); Switzerland (17); Yugoslavia (201).

Table 47.—Major world trade in steel ingots and semimanufactures in 1968, by areas

(Thousand metric tons)

Exporting countries and areas	Destinations [1]						
	North America		Latin America [2]	Europe			
	Canada	United States		European Economic Community	European Free Trade Association	Other non-Communist	Communist [3]
North America:							
Canada	XX	970.6	149.8	52.7	90.9	1.0	([6])
United States	349.2	XX	465.0	116.6	88.0	76.4	15.0
Total	349.2	970.6	614.8	169.3	178.9	77.4	15.0
Europe:							
European Economic Community:							
Belgium-Luxembourg	157.0	1,703.0	271.0	7,158.0	784.0	306.0	87.0
France	72.0	1,035.2	246.8	2,838.5	1,028.4	218.9	287.2
Germany, West	157.3	2,826.9	344.1	4,861.3	1,794.4	543.0	842.0
Italy	2.2	242.7	50.6	780.9	198.6	152.4	288.6
Netherlands	.3	286.0	34.2	933.4	453.2	25.2	36.2
Subtotal	388.8	6,093.8	946.7	16,572.1	4,258.6	1,240.5	1,541.0
European Free Trade Association:							
Austria	7.1	14.4	11.0	637.9	261.4	21.7	343.2
Denmark	-------	.7	.6	104.3	149.8	4.6	1.2
Norway	([6])	6.1	9.7	89.1	318.6	42.2	1.5
Portugal	([6])	([6])	([6])	1.0	19.5	3.7	-------
Sweden	15.7	78.7	22.8	422.0	549.3	128.0	128.8
Switzerland [7]	1.2	9.9	1.0	38.8	29.4	3.1	1.7

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United Kingdom	148.9	1,111.9	276.7	440.8	524.3	525.1	122.1
Subtotal	172.9	1,221.7	321.8	1,733.9	1,852.3	728.4	598.5
Other non-Communist Europe:							
Finland	(5)	.3	.1	31.7	115.6	(5)	.7
Greece	--------	.9	--------	1.2	3.5	13.4	6.4
Spain	(5)	14.9	17.5	21.4	13.7	2.6	31.6
Subtotal	(5)	16.1	17.6	54.3	132.8	16.0	38.7
European Communist Countries:							
Bulgaria	--------	--------	2.3	157.3	114.7	50.3	200.5
Czechoslovakia	78.5	19.5	6.1	481.0	244.0	64.0	996.5
Germany, East [8]	--------	--------	NA	15.8	17.0	9.8	100.4
Hungary	--------	--------	.2	68.0	83.1	24.2	291.9
Poland	18.6	114.1	113.7	161.3	193.7	31.0	633.9
Rumania	NA	NA	NA	NA	NA	NA	NA
U.S.S.R.	5.8	--------	211.6	29.1	160.4	182.9	4,644.2
Yugoslavia	--------	1.9	19.8	84.4	2.8	(5)	235.6
Subtotal	97.9	135.5	353.7	996.9	815.7	362.2	7,108.0
Total	659.6	7,467.1	1,639.8	19,357.2	7,059.4	2,347.1	9,281.2
Africa: South Africa, Republic of	.3	5.5	.3	6.3	1.9	62.1	--------
South Asia and Far East:							
India [9]	.1	9.5	.1	.2	7.5	.2	219.9
Japan	190.0	6,617.0	643.0	210.0	60.0	133.0	209.0
Total	190.1	6,626.5	643.1	210.2	67.5	133.2	428.9
Oceania: Australia	10.6	78.2	20.0	33.7	105.3	69.6	--------
Grand total	1,209.8	15,142.9	2,918.0	19,776.7	7,413.0	2,689.4	9,725.1

See footnote at end of table.

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Table 47.—Major world trade in steel ingots and semimanufactures in 1968, by areas—Continued

(Thousand metric tons)

Exporting countries and areas	Destinations [1]							
	Africa	Near East [4]	South Asia and Far East			Oceania	Unallocated	Total
			Japan	Other non-Communist	Communist [5]			
North America:								
Canada	5.1	2.4	0.2	10.7	--------	17.8	0.2	1,300.9
United States	104.4	37.4	6.0	709.1	--------	21.8	--------	1,988.9
Total	109.5	39.8	6.2	719.8	--------	39.1	.2	3,289.8
Europe:								
European Economic Community:								
Belgium-Luxembourg	323.0	211.0	1.0	132.0	19.0	10.0	--------	11,162.0
France	565.2	270.8	--------	79.4	40.4	22.5	4.8	6,705.1
Germany, West	345.8	512.3	7.2	197.3	338.0	10.8	--------	12,780.4
Italy	293.5	256.1	(6)	34.8	62.8	15.3	5.1	2,383.6
Netherlands	33.9	27.3	.8	22.1	.4	.2	--------	1,853.2
Subtotal	1,561.4	1,277.5	9.0	465.6	460.6	58.8	9.9	34,884.3
European Free Trade Association:								
Austria	12.8	32.3	.3	8.0	4.0	1.6	1.0	1,356.7
Denmark	.5	1.2	--------	.6	--------	--------	--------	263.5
Norway	1.8	2.1	(6)	.1	--------	(6)	--------	471.2
Portugal	33.6	3.4	--------	--------	--------	.1	.6	61.9
Sweden	8.4	4.0	2.8	13.6	15.5	7.2	--------	1,396.8
Switzerland [7]	.5	.8	NA	.3	NA	NA	3.2	89.9
United Kingdom	276.6	328.4	1.7	349.0	83.7	170.9	.2	4,360.3
Subtotal	334.2	372.2	4.8	371.6	103.2	179.8	5.0	8,000.3
Other non-Communist Europe:								
Finland	--------	.9	--------	--------	8.4	--------	--------	157.7
Greece	.3	.8	--------	--------	--------	--------	--------	26.5
Spain	23.0	6.4	--------	(6)	--------	.4	--------	131.5
Subtotal	23.3	8.1	--------	(6)	8.4	.4	--------	315.7
European Communist Countries:								
Bulgaria	1.5	54.6	1.0	2.7	1.6	--------	--------	586.5
Czechoslovakia	58.6	143.6	--------	27.7	38.3	.9	.1	2,153.8
Germany, East [8]	NA	.2	--------	NA	NA	--------	--------	143.2
Hungary	14.8	174.5	--------	29.1	3.7	.2	--------	689.7
Poland	49.7	35.5	--------	29.4	27.1	--------	--------	1,408.0
Rumania	NA	NA	NA	NA	NA	NA	681.6	681.6

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U.S.S.R.	82.8	398.2	-------	80.8	99.5	-------	76.7	5,972.0
Yugoslavia	4.5	5.6	-------	5.1	.8	-------	-------	360.5
Subtotal	211.9	812.2	1.0	174.8	171.0	1.1	758.4	11,995.3
Total	2,130.8	2,470.0	14.8	1,012.0	743.2	240.1	773.3	55,195.6
Africa: South Africa, Republic of	-------	(6)	(6)	.3	-------	.1	209.6	286.4
South Asia and Far East:								
India [9]	56.3	320.6	28.6	234.8	-------	20.9	-------	898.7
Japan	313.0	417.0	XX	2,606.0	1,002.0	374.0	-------	12,774.0
Total	369.3	737.6	28.6	2,840.8	1,002.0	394.9	-------	13,672.7
Oceania: Australia	16.1	.9	30.5	336.6	11.5	236.8	8.3	953.1
Grand total	2,625.7	3,248.3	80.1	4,909.5	1,756.7	911.0	991.4	73,397.6

NA Not available. XX Not applicable.

[1] Because some countries do not report destinations for a portion of exports (see unallocated column), figures given for distribution of those countries' exports by continental area are not exactly correct. However, such unallocated quantities are sizable only in the case of Rumania, the U.S.S.R., and the Republic of South Africa.

[2] All Western Hemisphere areas except United States and Canada.

[3] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, U.S.S.R., and Yugoslavia.

[4] Bahrain, Cyprus, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Muscat and Oman, Qatar, Saudi Arabia, Southern Yemen (formerly Aden), Syria, Trucial States, Turkey, and Yemen.

[5] Consists of mainland China, North Korea, and North Vietnam; Mongolia is included under Other non-Communist South Asia and Far East, owing to its inseparability from this group in source.

[6] Less than 50 tons.

[7] Source: Statistical Office of the United Nations. World Trade Annual. V. III, Walker and Co., New York, 1970, pp. 395–432.

[8] Partial figure derived from import data of partner countries. Sources: Statistical Office of the United Nations. 1968 Supplement to The World Trade Annual. V. I Walker and Co., New York, 1970, p. 263, for all data except those for Poland and Bulgaria (included in Communist Europe), which are from official trade returns of those countries.

[9] Year beginning April 1968 and ending March 1969.

Source: Except where otherwise noted: United Nations Economic Commission for Europe. Statistics of World Trade in Steel. 1968, 57 pp.

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Table 48.—World trade of lead ores and concentrates [1]

(Thousand metric tons of contained metal unless otherwise specified)

Destination	Exporting regions								
	North America	Latin America [2]	Western Europe [3]	Eastern Europe [4]	Africa	Asia	Oceania	Origin not reported by continent	Total
1968									
United States	32.6	26.5	-----	-----	0.6	([5])	18.7	-----	78.4
Western Europe:									
Belgium-Luxembourg [6]	53.6	38.7	40.8	-----	-----	-----	5.7	14.8	153.6
France	1.8	17.6	28.0	-----	26.0	-----	12.0	-----	80.4
Germany, West [7]	49.6	14.7	51.6	6.7	8.7	1.4	2.8	-----	135.5
United Kingdom	7.4	-----	2.8	-----	-----	-----	21.2	17.6	49.0
Other [8]	-----	-----	7.9	-----	19.1	-----	-----	.1	27.1
Total	112.4	71.0	126.1	6.7	53.8	1.4	41.7	32.5	445.6
Japan	30.3	17.6	-----	-----	-----	15.2	14.4	.5	78.0
Grand total	175.3	115.1	126.1	6.7	54.4	16.6	74.8	33.0	602.0
1969									
United States	44.0	36.3	-----	-----	.3	-----	18.4	-----	99.0
Western Europe:									
Belgium-Luxembourg [9]	23.0	32.3	14.7	-----	-----	-----	-----	14.6	84.6
France [7]	-----	9.9	33.3	-----	25.0	-----	3.5	-----	71.7
Germany, West [7]	20.7	21.0	61.9	4.6	7.6	.5	2.9	-----	119.2
United Kingdom	7.0	5.6	9.2	-----	1.8	-----	17.8	12.2	53.6
Other [10]	-----	5.9	10.5	-----	10.4	-----	-----	-----	26.8
Total	50.7	74.7	129.6	4.6	44.8	.5	24.2	26.8	355.9
Japan	36.0	38.1	-----	-----	.8	14.4	29.0	1.1	119.4
Grand total	130.7	149.1	129.6	4.6	45.9	14.9	71.6	27.9	574.3

[1] Imports of countries other than those listed believed small.
[2] Includes Mexico.
[3] Includes Yugoslavia.
[4] Includes Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and U.S.S.R.
[5] Less than 50 tons.
[6] Data are for gross weight of ore, January through October.
[7] January through November.
[8] Includes Italy, gross weight of ore for January through August, and Austria for January through September.
[9] Data are for gross weight of ore, January through September.
[10] Includes Italy, gross weight of ore for January through September, and Austria for January through September.

Source: Monthly Bulletin of the International Lead and Zinc Study Group, Lead and Zinc Statistics. April 1969, v. 9, No. 4, p. 24, April 1970, v. 10, No. 4, p. 24.

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Table 49.—Major world trade in lead bullion and refined lead [1]

(Thousand metric tons)

Destination	Exporting regions								
	North America	Latin America [2]	Western Europe [3]	Eastern Europe [4]	Africa	Asia	Oceania	Origin not reported by continent	Total [5]
1968									
United States	54.6	119.4	82.3	-----	7.5	-----	42.6	0.3	306.7
Western Europe:									
Belgium-Luxembourg [6]	.2	-----	9.7	-----	-----	-----	-----	3.5	13.4
France	-----	.5	15.5	2.1	25.3	1.2	-----	.6	45.2
Germany, West	12.0	1.7	53.4	4.3	3.4	1.5	11.7	-----	88.0
Italy [7]	.8	9.8	1.3	10.8	10.1	-----	3.0	10.1	45.9
Netherlands	-----	9.5	19.6	6.5	1.1	2.6	2.0	-----	41.3
Switzerland	4.2	2.8	10.2	.2	1.2	.6	.9	.1	20.2
United Kingdom	49.5	-----	2.9	2.5	13.0	-----	148.6	.3	216.8
Other [8]	1.7	5.0	24.2	7.8	7.2	.1	-----	.5	46.4
Total	68.4	29.3	136.8	34.2	61.3	6.0	166.2	15.1	517.2
Japan	3.8	.2	.2	.9	2.6	1.7	2.2	-----	11.6
Grand total	126.8	148.9	219.3	35.1	71.4	7.7	211.0	15.4	835.5
1969									
United States	42.1	104.0	40.9	-----	11.4	-----	55.1	.9	254.4
Western Europe:									
Belgium-Luxembourg [9]	([10])	.3	6.8	1.6	-----	.5	-----	1.8	11.0
France [6]	-----	1.5	26.7	1.0	27.6	-----	-----	-----	56.8
Germany, West	12.0	1.8	65.7	1.7	2.0	10.9	14.3	.8	109.2
Italy [9]	-----	7.0	5.6	5.8	14.3	-----	-----	14.8	47.5
Netherlands	-----	7.8	22.1	7.2	1.1	.2	1.1	.1	39.6
Switzerland	2.5	8.1	16.0	.8	.5	2.6	.5	([10])	26.0
United Kingdom	43.4	-----	.7	.2	12.7	-----	172.1	.1	229.2
Other [11]	3.8	5.2	26.1	7.5	5.4	-----	-----	.8	48.8
Total	61.7	26.7	169.7	25.8	63.6	14.2	188.0	18.4	568.1
Japan	1.3	-----	-----	-----	2.6	1.1	1.5	1.8	8.3
Grand total	105.1	130.7	210.6	25.8	77.6	15.3	244.6	21.1	830.8

[1] Imports of countries other than those listed are generally small individually (except for Eastern European nations listed in footnote 4), but in aggregate apparently total about 125,000 tons per year. Total lead imports by East European countries, including trade between the countries of this group, apparently totals 70,000 tons or more annually.

[2] Includes Mexico.

[3] Includes Yugoslavia.

[4] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and U.S.S.R.

[5] Reported totals, detail may not add horizontally owing to rounding.

[6] January through November.

[7] January through October.

[8] Includes Austria (January through September) and Denmark, Finland, Ireland, Norway, and Sweden (January through December).

[9] January through September.

[10] Less than 50 tons.

[11] Includes Austria (January through September), Ireland (January through November), and Denmark, Finland, Norway, and Sweden (January through December).

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Table 50.—World trade of zinc ores and concentrates [1]

(Thousand metric tons of contained metal unless otherwise specified)

Destination	Exporting regions								
	North America	Latin America [2]	Western Europe [3]	Eastern Europe [4]	Africa	Asia	Oceania	Origin not reported by continent	Total
1968									
United States	281.8	185.3	8.4	-----	18.2	-----	2.1	-----	[5] 495.7
Western Europe:									
Belgium-Luxembourg [6]	254.5	-----	74.6	-----	61.1	-----	-----	102.5	492.7
France	38.0	19.0	98.4	0.3	33.9	-----	-----	-----	189.6
Germany, West [7]	54.4	8.9	35.0	.2	1.7	0.5	-----	-----	100.7
United Kingdom	86.1	2.0	3.0	-----	-----	-----	90.4	35.2	166.7
Other [8]	31.6	.2	64.8	-----	.5	1.5	13.6	-----	112.2
Total	414.6	30.1	275.8	.5	97.2	2.0	104.0	137.7	1,061.9
Japan	43.1	257.6	5.9	13.0	-----	32.6	51.5	5.5	409.2
Grand total	739.5	473.0	290.1	13.5	115.4	34.6	157.6	143.2	[5] 1,966.8
1969									
United States	333.4	198.5	-----	-----	11.3	-----	2.7	.4	546.3
Western Europe:									
Belgium-Luxembourg [9]	219.3	-----	106.0	-----	47.5	-----	-----	52.9	425.7
France [7]	56.6	42.2	79.8	-----	41.3	.2	-----	7.7	227.8
Germany, West [7]	90.2	1.8	49.2	-----	5.2	1.0	9.8	-----	157.2
United Kingdom	19.2	3.7	15.8	-----	-----	-----	95.7	30.4	164.8
Other [8]	29.9	.8	74.1	-----	-----	-----	8.1	-----	112.9
Total	415.2	48.5	324.9	-----	94.0	1.2	113.6	91.0	1,088.4
Japan	39.2	247.3	-----	-----	-----	36.2	70.1	42.1	434.9
Grand total	787.8	494.3	324.9	-----	105.3	37.4	186.4	133.5	2,069.6

[1] Imports of countries other than those listed believed small.
[2] Includes Mexico.
[3] Includes Yugoslavia.
[4] Includes Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and U.S.S.R.
[5] Reported totals; detail does not add horizontally, apparently owing to rounding.
[6] Data are for gross weight of ore, January through October.
[7] January through November.
[8] Includes Netherlands and Norway, January through December; and Austria, January through September.
[9] Data are for gross weight of ore, January through September.

Source: Monthly Bulletin of the International Lead and Zinc Study Group, Lead and Zinc Statistics. April 1969, v. 9, No. 4, p. 25; April 1970, v. 10, No. 4, p. 25.

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Table 51.—Major world trade in refined zinc [1]

(Thousand metric tons)

Destination	Exporting regions								
	North America	Latin America [2]	Western Europe [3]	Eastern Europe [4]	Africa	Asia	Oceania	Origin not reported by continent	Total [5]
1968									
United States	106.0	66.0	27.1	8.2	8.7	-----	17.3	43.8	277.1
Western Europe:									
Belgium-Luxembourg [6]	3.1	-----	1.8	-----	8.0	-----	2.4	3.0	18.3
France	1.2	-----	17.0	4.4	.8	1.7	-----	.2	25.3
Germany, West	11.1	.3	133.3	15.5	19.0	-----	.1	.8	180.1
Italy [7]	.7	1.7	17.2	2.3	4.7	-----	.9	5.7	33.2
Netherlands	-----	-----	4.4	1.8	.2	9.0	.9	.2	16.5
Sweden	5.1	.4	18.9	9.1	1.4	-----	-----	.1	35.0
Switzerland	.6	-----	17.4	1.4	3.6	2.8	-----	(8)	25.8
United Kingdom	99.1	1.9	35.8	21.2	2.1	4.3	5.7	1.4	171.5
Other [9]	-----	-----	15.3	5.3	1.8	.2	-----	1.6	24.2
Total	120.9	4.3	261.1	61.0	41.6	18.0	10.0	13.0	529.9
Hong Kong [10]	2.4	-----	.6	-----	-----	1.2	1.2	.7	6.1
Japan	3.6	-----	-----	-----	-----	3.5	.1	(8)	7.2
Grand total	232.9	70.3	288.8	69.2	50.3	22.7	28.6	57.5	820.3
1969									
United States	134.9	38.4	21.4	8.6	9.3	-----	31.1	50.8	294.5
Western Europe:									
Belgium-Luxembourg [10]	-----	-----	1.3	-----	15.1	5.5	4.3	6.6	32.8
France [6]	.7	.1	15.0	4.4	2.8	.1	-----	.5	23.6
Germany, West	11.6	2.4	120.5	14.0	21.2	-----	5.4	-----	175.1
Italy [6]	2.3	1.0	15.9	2.6	3.1	-----	2.0	2.9	29.8
Netherlands	-----	-----	4.5	3.0	2.2	5.8	.9	-----	16.4
Sweden	4.8	.1	24.5	9.7	-----	-----	-----	-----	39.1
Switzerland	.3	.1	17.2	2.9	3.9	4.9	1.8	(8)	31.1
United Kingdom	99.2	2.4	17.5	20.9	3.3	2.3	16.5	1.2	163.3
Other [11]	-----	.2	23.0	5.1	2.5	.1	-----	.3	31.3
Total	118.9	6.3	289.4	62.6	54.1	18.7	30.9	11.5	542.5
Hong Kong	1.7	-----	.3	-----	-----	1.1	2.2	1.3	6.6
Japan	2.2	.1	-----	-----	.1	4.0	-----	.7	7.1
Grand total	257.7	44.8	261.1	71.2	63.5	23.8	64.2	64.3	850.7

[1] Imports of countries other than those listed are generally less than those of listed countries individually, except for the following countries (total 1968 imports of each given parenthetically, in thousand tons): India (66.0); Brazil (43.1); Republic of South Africa (38.9); U.S.S.R. (36.4); Hungary (18.2); Philippines (16.3); Thailand (14.6); and Taiwan (10.6). The aggregate tonnage of imports for nations not listed in body of table nor in the foregoing list is estimated to be about 95,000 metric tons.

[2] Includes Mexico.

[3] Includes Yugoslavia.

[4] Includes Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and U.S.S.R.

[5] Reported totals; detail may not add horizontally owing to rounding.

[6] January through November.

[7] January through October.

[8] Less than 50 tons.

[9] Includes Austria (January through September), and Denmark, Finland, and Ireland (January through December).

[10] January through September.

[11] Includes Austria (January through September), Ireland (January through November), Denmark and Finland (January through December).

Source: Monthly Bulletin of the International Lead and Zinc Study Group, Lead and Zinc Statistics. May 1969, v. 9, No. 5, pp. 26–27, May 1970, v. 10, No. 5, pp. 26–27.

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Table 52.—World movement of solid fuels in 1968 [1]

(Thousand metric tons, standard coal equivalent)

Source areas	Destinations				
	North America [2]	Caribbean America [3]	Other America [4]	Western Europe [5]	Africa
North America [2]	16,030	520	2,360	13,860	--
Western Europe [5]	70	180	110	39,650	290
Africa	--	--	--	220	1,370
Far East	--	--	--	--	10
Oceania	--	--	--	--	10
Other countries [6]	10	110	130	28,630	650
Total [7]	16,110	810	2,600	77,360	2,330

Source areas	Destinations				
	Near East	Far East	Oceania	Other countries [6]	World [7]
North America [2]	20	15,580	--	170	48,540
Western Europe [5]	10	40	40	340	40,820
Africa	--	440	10	--	2,280
Far East	--	800	--	--	810
Oceania	--	12,140	300	--	12,460
Other countries [6]	--	5,240	--	33,290	63,570
Total [7]	30	34,240	350	33,800	168,480

[1] Data based on the general trade system; lignite briquets are reduced to standard coal equivalent before inclusion; bunker loadings are excluded.
[2] Bermuda, Canada, Greenland, St. Pierre, and the United States.
[3] Mexico, all areas of Central America, all Islands of the Caribbean, Colombia, and Venezuela.
[4] All South America except Colombia and Venezuela.
[5] All non-Communist nations of Europe and Yugoslavia.
[6] Chiefly the Communist nations of Europe and Asia, but apparently including some other countries not identified separately.
[7] Reported totals; detail does not add to listed totals because of: (1) inclusion of quantities shipped to or received from areas not listed separately or not identified in original sources, and (2) rounding.

Source: Statistical Office of the United Nations. World Energy Supplies 1965–68. Series J, No. 13, New York, 1969, pp. 42–47.

Table 53.—World movement of crude petroleum in 1968 [1]

(Thousand metric tons)

Source areas [2]	Destinations				
	North America	Caribbean America	Other America	Western Europe	Africa
North America	22,640	50	--	50	--
Caribbean America	37,830	63,800	6,370	25,230	70
Other America	1,200	470	210	170	--
Western Europe	--	--	--	870	--
Africa	8,090	5,270	2,110	161,840	1,790
Near East	15,950	2,400	9,960	253,810	14,060
Far East	3,850	120	--	180	--
Other countries	--	4,000	420	25,100	1,670
Total [3]	89,560	76,110	19,070	467,250	17,590

Source areas [2]	Destinations				
	Near East	Far East	Oceania	Other countries	World
North America	--	140	--	--	22,880
Caribbean America	--	490	--	--	134,100
Other America	--	30	--	--	2,070
Western Europe	--	--	--	--	870
Africa	730	220	240	400	180,780
Near East	21,520	150,280	15,240	800	487,780
Far East	--	19,020	5,900	--	29,090
Other countries	--	940	--	27,420	59,550
Total [3]	22,250	171,120	21,380	28,620	917,120

[1] Data are based on the general trade system.
[2] For details on countries included in each area, see footnotes to table 52.
[3] Reported totals; detail does not add to listed totals because of: (1) inclusion in totals of quantities shipped to or received from not listed separately or not identified in original sources, and (2) rounding.

Source: Statistical Office of the United Nations. World Energy Supplies 1965–68. Series J, No. 13, New York, 1970, pp. 82–89.

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Table 54.—Refined petroleum fuel trade, by continental areas [1]

(Million metric tons)

Continental areas [2]	Exports		Imports		Bunkers	
	1967	1968	1967	1968	1967	1968
North America	7.63	7.21	78.82	87.42	18.58	21.09
Caribbean America	111.55	118.40	18.65	13.37	13.47	14.23
Other America	.93	1.04	4.07	4.96	1.38	1.32
Western Europe	69.92	80.09	103.03	103.65	38.54	41.94
Eastern Europe	33.20	36.36	6.78	7.01	NA	NA
Africa	4.07	4.84	11.01	12.42	8.12	8.00
Near East	45.18	51.06	2.46	2.60	17.24	17.56
Far East	18.93	20.51	37.50	41.90	20.45	22.51
Oceania	1.29	1.15	3.50	3.66	4.03	4.21
Not specified [3]	.02	--------	.02	.01	.03	.05
Total	292.72	315.66	260.84	277.00	121.84	130.91

NA Not available.

[1] Figures given are for fuel commodities only, excluding lubricants and other refinery products not normally used as energy sources. Apparent discrepancies between export, import, and bunker totals evidently result from quantities of material en route at yearend, from incomplete data, and from differing practices from country to country in the method of reporting bunkering materials.

[2] Continental areas are the same as those used in table 52 except that Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and the U.S.S.R. are reported under the group term Eastern Europe.

[3] Derived figure; difference between listed detail and reported total.

Source: Statistical Office of the United Nations. World Energy Supplies 1965–68. Series J, No. 13, New York, 1970, pp. 60–80.

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The Mineral Industry of Algeria

By Agnes J. Doughman [1]

In 1969 Algeria became a member of the Organization of Petroleum Exporting Countries (OPEC). During the year there were several areas of disagreement between the Algerian Government and the foreign oil companies; arbitration proceedings resulting from the merger of Sinclair Oil Corp. and Atlantic Richfield Oil Co. were taken before the International Court of Justice at The Hague. Negotiations with France were underway regarding changes in the crude oil reference price set in the 1965 oil pact. It appeared that Algeria's policy was to create further joint ventures in the petroleum industry similar to the agreement made by the state-owned Algerian company Société Nationale pour la Recherche, la Production, la Transport, la Transformation, et la Commercialisation des Hydrocarbures (SONATRACH) with Getty Oil in 1968.

On January 1, 1969, the Algerian Government advised oil companies with shut-in wet gasfields that they would have until January 31 to make proposals for recycling operations to extract the condensates by yearend.

The policy of the Algerian Government in exploiting its mineral wealth is based on four principles:

1. The transformation of the basic mining sector structure to ensure exploitation in the interests of the Algerian people.

2. Rehabilitation and modernization of all mines.

3. Implementation of a mining and geological research program to determine the economic possibilities of various deposits.

4. Encourage the marketing and treatment of a greater variety and volume of products from indigenous sources. The construction of a steel complex represents the first step in Algeria's attempt in industrialization.

Algeria was making considerable progress in exploiting its natural gas reserves. The world's first liquefied natural gas (LNG) plant at Arzew, in operation since 1964, was exporting its product mostly to the United Kingdom and to France. The second and the world's largest LNG plant was well under construction at Skikda. A third and still larger gas liquefaction plant was envisaged at Arzew in the tentative agreement reached in 1969 between El Paso Natural Gas Co. and SONATRACH. Although El Paso has gaslines only in the Western United States, the agreement could result in deliveries of as much as 10 billion cubic meters of gas per year to the U.S. east coast beginning in 1973. El Paso apparently would make sales to east coast transmission distribution companies under the agreement, which runs for 25 years.

PRODUCTION

With the exception of crude petroleum and marketed natural gas, Algerian production data for 1969 has been estimated. Output of natural gas indicated a significant increase, and other commodities apparently continued at about the same level attained in 1968.

[1] Statistical assistant, Bureau of Mines, Washington, D.C.

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Table 1.—Algeria: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969 [2]
METALS			
Aluminum:			
Unwrought	• 150	• 150	150
Semimanufactures, including alloys	• 230	• 230	230
Antimony:			
Concentrate	366	r 195	215
Metal content	r 102	54	60
Copper:			
Concentrate	r 4,169	3,424	2,500
Metal content	r 1,050	• 850	625
Refined, including alloys	• 2,000	2,560	2,500
Iron and steel:			
Iron ore—thousand tons	r 2,538	3,079	3,500
Pig iron	• 10,000	• 10,000	60,000
Ingots and equivalent forms	r 23,470	27,832	30,000
Semimanufactures	r 33,709	46,108	50,000
Lead:			
Concentrate	r 5,123	7,790	9,400
Metal content	r 3,580	• 5,400	6,500
Refined, including alloys	1,125	1,527	2,000
Silver [3]—thousand troy ounces	100	100	100
Zinc:			
Concentrate	r 13,168	35,177	36,000
Metal content	r 8,150	• 21,700	22,200
NONMETALS			
Barite	r 31,354	44,985	32,000
Cement—thousand tons	r 731	r 866	950
Clay, bentonitic	r 16,486	19,295	20,000
Diatomite	r 18,263	21,367	22,000
Fertilizer materials:			
Phosphate rock—thousand tons	193	366	400
Superphosphate—do	78	115	120
Fuller's earth	38,310	• 40,000	40,000
Gypsum—thousand tons	• 175	• 175	175
Lime—do	• 20	• 20	20
Pyrite	r 34,379	46,175	50,000
Salt—thousand tons	r 120	• 120	120
Sulfur, elemental	21,118	21,712	22,000
MINERAL FUELS AND RELATED MATERIALS			
Coal—thousand tons	r 11	(4)	27
Coke (low-temperature)—do	r NA	NA	NA
Natural gas, marketed—million cubic feet	76,226	r 85,669	105,403
Liquefied natural gas—thousand 42-gallon barrels	11,000	12,500	16,000
Natural gas liquids (condensate)—do	5,600	r 6,300	7,905
Petroleum:			
Crude—do	r 297,715	r 334,624	338,015
Refinery products: [5]			
Gasoline and naphthas—do	4,421	4,515	NA
Kerosine and jet fuel—do	1,596	1,635	NA
Distillate fuel oil—do	5,063	5,160	NA
Residual fuel oil—do	2,625	2,685	NA
Liquefied petroleum gas—do	942	960	NA
Other unspecified—do	39	45	NA
Total—do	14,686	15,000	15,000

• Estimated. r Revised. NA Not available.

[1] In addition to commodities listed, Algeria produces other construction materials, but data on output are not available.

[2] All data estimated except for marketed natural gas and crude petroleum.

[3] Estimated recoverable silver content of lead and zinc concentrates.

[4] Less than ½ unit.

[5] Output from Algiers refinery; excludes output from Hassi Messaoud topping plant.

TRADE

Available trade data for 1968 indicate a significant increase over the previous year in exports of petroleum, natural gas, and iron ore. Considering lesser mineral commodities in total, exports were about on a par for 1967 in terms of value. Among 1968 mineral commodity imports, manufactured fertilizers and iron and steel semimanufactures, mainly tubes and pipes indicated the most significant increases. The increase in tubes and pipes was attributed to the demand for pipeline construction.

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Table 2.—Algeria: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Copper:			
Ore and concentrate		245	[1] 5,165
Metal, including alloys, all forms		1,588	2,108
Iron and steel:			
Ore and concentrate	thousand tons	345	3,206
Semimanufactures		r 3,338	1,501
Scrap		23,070	6,600
Lead:			
Ore and concentrate		6,636	4,115
Metal, including alloys, all forms		1,017	1,167
Zinc:			
Ore and concentrate		r 13,215	22,170
Metal, including alloys, all forms		1,782	222
NONMETALS			
Barite and witherite		29,200	7,998
Cement	thousand tons	63	15
Diatomite		6,789	11,906
Fuller's earth		12,477	17,376
Phosphate rock	thousand tons	88	245
Pyrite		12,800	e 18,000
Salt and brines		45,173	39,774
MINERAL FUELS AND RELATED MATERIALS			
Liquefied natural gas	thousand 42-gallon barrels	e 12,000	15,900
Petroleum:			
Crude	do	278,031	305,912
Refinery products:			
Gasoline	do	r 983	1,305
Kerosine and jet fuel	do	r 541	528
Distillate fuel oil	do	r 2,355	1,559
Residual fuel oil	do	r 2,516	1,918
Liquefied petroleum gas	do	110	25
Total	do	r 6,505	5,335

e Estimate. r Revised.
[1] From Annales des Mines, July–August, 1969.

Major destinations of selected commodities, 1968

(Metric tons unless otherwise specified)

Commodity	Quantity
METALS	
Copper, total	5,165
Japan	5,165
Iron ore and concentrate, total thousand tons	3,206
Italy do	1,109
Poland do	612
Rumania do	573
Belgium-Luxembourg do	377
France do	145
Lead ore and concentrate, total	4,115
Greece	2,060
Italy	2,055
Zinc ore and concentrates, total	22,170
Italy	15,970
Spain	3,200
Belgium-Luxembourg	3,000
MINERAL FUELS AND RELATED MATERIALS	
Liquefied natural gas, total thousand 42-gallon barrels	[1] 15,900
Petroleum, crude, total do	305,912
France do	181,648
West Germany do	49,941
Italy do	18,331
Switzerland do	11,611
Belgium-Luxembourg do	11,585

[1] Mainly to France and United Kingdom.

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Table 3.—Algeria: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, all forms	1,345	2,643
Copper, metal, including alloys, all forms	1,854	2,766
Iron and steel:		
Scrap	19	------
Pig iron, ferroalloys, similar materials	644	914
Semimanufactures	r 142,716	334,143
Lead:		
Ore and concentrate	48	32
Oxide	103	108
Metal, including alloys:		
Unwrought	1,642	2,528
Semimanufactures	83	89
Silver, metal, including alloys, troy ounces	• 8,160	• 22,000
Tin, metal, including alloys, long tons	67	66
Titanium oxide	238	220
Zinc:		
Oxide	290	251
Metal, including alloys:		
Unwrought	150	215
Semimanufactures	314	546
NONMETALS		
Asbestos	1,826	1,463
Cement	11,494	15,649
Chalk	4,105	5,317
Clays	8,189	7,396
Dolomite	679	605
Fertilizer materials:		
Crude, nitrogenous	312	628
Manufactured:		
Nitrogenous	68,737	83,109
Phosphatic	12,564	66,256
Potassic	14,306	30,658
Other, including mixed	500	(1)
Lime	2,586	2,820
Pigments, mineral, including processed iron oxides	418	586
Quartz and quartzite	10	11
Salt	41	13
Sulfur, elemental, all forms	23,532	36,952
Talc, steatite, soapstone, and pyrophyllite	1,819	2,104
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	5	39
Coal, all grades, including briquets	51,990	56,242
Coke and semicoke	4,707	6,629
Petroleum:		
Refinery products:		
Gasoline, thousand 42-gallon barrels	r 26	260
Kerosine and jet fuel, do	r 69	140
Distillate fuel oil, do	r 35	23
Residual fuel oil, do	r 12	(1)
Liquefied petroleum gas, do	102	204
Lubricants, do	225	264
Mineral jelly and wax, do	r 25	23
Other, do	r 322	886
Total, do	r 816	1,300
Mineral tar and other coal petroleum, or gas-derived crude chemicals	3,119	916

• Estimate. r Revised.

[1] Less than ½ unit

COMMODITY REVIEW

METALS

Copper.—There has been no further report on the $1.8 million contract between the Japanese Dowa Mining Co. and Algerian Mineral Resources Development Corp. (AMRDC) for 8,000 tons of copper concentrates to be shipped over a 2-year period starting in October 1968. The contract provides that Dowa Mining Co. will supply technical aid to develop the Ain Barber copper mines. Reserves are estimated at 3 million metric tons containing 4 percent copper.

Iron Ore.—New equipment was installed in 1969 at the Ouenza-Boukhadra mine to increase the iron ore production to a new level of 3 to 4 million tons annually. An investigation of other iron deposits has been undertaken. Pelletization of iron ore has been considered, but a definite deci-

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sion to construct a plant has not been reached.

Iron and Steel.—Production started in August at the first completed units of the Annaba iron and steel complex at El Hadjar with a daily output of 900 tons of pig iron. The smelter was using indigenous iron ore and imported coke. The first 15,000 tons of pig iron produced was shipped to Japan as part of a 41,000-ton barter agreement for steel pipe. Almost all the pig iron output was to be exported until the steelmaking facility, scheduled for completion in 1970, was in operation. The completed plant will produce cast iron, steel pipe, and hot and cold rolled plate and is to have an annual capacity of 400,000 tons of steel.

Lead and Zinc.—The Algerian Government was attempting to increase zinc output, which declined rapidly following nationalization and closure of the El Abed lead-zinc mine. The mine was reopened in 1968 and plans were being made for the construction of concentrators at El Abed, at the lead and zinc mines of Kherzet-Youssef near Setif, and at the Kef Oum Thebaul mine near LaCalle. A 10,000-ton-per-year electrolytic zinc plant (originally reported as 40,000 tons) is planned near El Abed with byproduct production scheduled to include an annual output of 140 tons of cadmium and 60,000 tons of sulfuric acid. Information was not available as to when construction would start.

In September a contract was signed by a Polish company, Cetrozap, to develop the lead and zinc deposits at Guerrouma and Sakamody (Grande Kabylie).

Mercury.—Work was to start late in 1969 on a mercury deposit in the Azzaba region near Ismail. It was expected that the mine and a plant, already under construction, would start production by mid-1970. Other deposits are known in the region, the most promising being at Mra-Sma. Total reserves are reported to contain 6,000 to 7,000 tons of mercury.

NONMETALS

Cement.—Although domestic production of cement increased, output was well below demand. A plant under construction at Hadjar-Soud will have an annual capacity of 500,000 tons and is expected to be in operation in 1971. In October 1969 a contract was signed by Fives-Lille-Cail of France to construct a 50,000-ton-per-year cement plant at Ain-Cherchar. This operation is scheduled to start in 1971. At year-end negotiations were underway for construction of another cement plant at Meftah.

Clays, Kaolin.—Development work was started on a kaolin deposit at Djebel Debagh. Annual output is expected to be about 4,000 tons of crude kaolin. A ceramic factory is to be established at Guelma, with production at both operations to start in mid-1970.

Fertilizer Materials.—Construction of the nitrogenous fertilizer complex at Arzew was completed in early 1969. The plant is designed to have a daily output of 1,000 tons of ammonia, 400 tons of nitric acid, 500 tons of ammonium nitrate, and 400 tons of urea. It has been reported that Algeria will consume only about 15 percent of the rated production.

A contract was awarded to Krebs et Cie, Paris, for construction of a 500,000-ton phosphate fertilizer plant at Annaba. The plant will use the Pechiney-Saint Gobain process for production of phosphoric acid and phosphate fertilizers. The Ugine-Kuhlman process will be used in producing sulfuric acid. Production is scheduled to start in mid-1971.

The reopening of the M'Zaita phosphate mine, near Tocqueville, was under investigation. Reserves are about 30 million tons of siliceous phosphate of metallurgical grade. Tests have indicated its possible use for the production of elemental phosphorus.

MINERAL FUELS

Natural Gas.—The 1969 production of natural gas increased about 23 percent, based upon marketed gas data.

In mid-year negotiations were started by SONATRACH and the El Paso Natural Gas Co., to export liquefied natural gas (LNG) to U.S. east coast markets. If prompt approval by the U.S. Government is received, deliveries are to start in late 1973. When approved, the project will require about a $1 billion investment, including a new pipeline, liquefaction plant, methane tankers, and other facilities. The gas for this project will probably be obtained from the Hassi R'Mel gasfield.

SONATRACH is to be responsible for extraction of the gas, pipeline transporta-

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tion, and LNG plant, and have a minor interest in the tankers. El Paso will be responsible for construction of the tankers and take delivery of the LNG at Arzew. To deliver the quantity of gas envisaged will probably require 10 tankers, each having a capacity of 3.5 billion cubic feet of LNG.

At yearend construction of a gas pipeline to transport gas to Italy was under consideration.

Petroleum.—Crude oil production in 1969 increased to over 925,000 barrels per day. Three companies, Société Nationale de Recherche et d'Exploration des Pétroles en Algérie (SNREPAL), Compagnie Francaise des Pétroles (Algérie) (CFPA), and Compagnie de Recherches et d'Exploitation du Pétrole au Sahara (CREPS) produced over 70 percent of the total output. The state-owned Algerian company SONATRACH produced less than 1 percent of the crude oil.

Effective March 31, 1969, French oil companies agreed to higher posted prices for crude oil of $2.665 per barrel at Arzew, $2.65 at Bougie, and $2.61 at La Skhirra. These postings, made under protest, were 13 percent above those previously in effect. Similar prices were posted by SONATRACH. The U.S. firms (excluding Getty), whose operations have been under Algerian control since June 1967, had new prices posted for them by their Algerian custodians, though disavowed by the firms' home offices. Only Compagnie des Pétroles d'Algérie (CPA) held out against Algerian pressure, and while agreeing to posted prices for the first time, set them at the old level of $2.365 at Arzew, $2.35 at Bougie, and $2.30 at La Skhirra. Getty's posted prices set in October 1968 remained unchanged.

Algeria notified non-French companies that they must pay royalty and tax on the new posted prices. Prices at Bougie were to be increased by 7.79 cents to compensate for the fact that royalty is not expensed. Another 7 cents was to be added to the total to reflect the value of Mediterranean crude with Suez closed. This additional 7 cents would also be applicable to the other two ports, plus 7.84 cents at Arzew and 7.68 cents at La Skhirra in lieu of royalty expensing.

After Algeria became a member of OPEC it reportedly informed several companies that royalty and tax were to be paid, retroactive to January 1, 1969, on the prices producers were forced to post in March.

In April the Algerian Government announced that the Sinclair Mediterranean Petroleum Co. had forfeited its holdings in Algeria because the Sinclair Oil Corp. merger in March into Atlantic Richfield Oil Co. did not comply with Algeria's existing legislation. These holdings included Sinclair's exclusive permits to Rhourde el Baguel and In Amedjene acreage, the concession to Rhourde et Baguel field, and pipelines. In May, proceedings for international arbitration were initiated.

Algeria offered Sinclair's exploration acreage on a pro rata basis to its partners, Getty Oil, Phillips Petroleum Co., and Société Petrolière Française en Algérie (SOPEFAL). Sinclair's share in the In Amedjene was accepted by the Algerian custodian for Phillips, under protest by Phillips management. Both U.S. companies had renounced their interests in this permit but the renunciation was never acknowledged by the Algerian custodians. Getty and SOPEFAL agreed to accept shares of the exploration portion of the Rhourde el Baguel producing concession, due in part to their desire to conform to texts which indicate that the remaining companies in a joint venture must divide shares of a partner that withdraws, although this was an involuntary withdrawal.

In September, Sinclair's 28-percent interest in the two fields and pipelines was offered to bidders with the terms so worded that SONATRACH would be the only company interested in bidding. After the October 30 closing date the Algerian Government announced to Sinclair's partners that SONATRACH had replaced Sinclair. Terms and conditions of the transfer were not published.

SONATRACH awarded a $70 million contract to a Japanese firm to construct a 50,000-barrel-per-day refinery at Arzew. It is expected to go on stream in early 1972 and will be the first wholly owned by SONATRACH.

A contract was awarded to French firms to construct Algeria's fourth crude oil pipeline. The line will be built in two segments. The first segment with 360,000 barrels per day capacity will run from the

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new Mesdar field to the Haoud el Hamra gathering center, and the second with 600,000 barrels per day capacity on to Skikda on the coast. Completion is scheduled for August 1971, and cost of the entire project will be about $80 million.

SONATRACH expected to begin the first offshore drilling in the Gulf of Arzew early in 1970. A $2.4 million contract was awarded by SONATRACH to a British firm for construction of liquefied petroleum gas facilities at Arzew to provide 3.5 million cubic feet of additional storage capacity. A completion date for April 1971 has been set.

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The Mineral Industry of Angola, Mozambique, and Portuguese Guinea

By Eugene R. Slatick [1]

ANGOLA

Angola's mineral industry in 1969 continued to be dominated by diamond, iron ore, and petroleum. In general, the industry developed steadily and the prospects for continued growth are favorable.

PRODUCTION AND TRADE

Mineral production was valued at about $167 million,[2] of which diamond accounted for $70 million, iron ore for $38 million, crude oil for $31 million, and petroleum products for $11 million.

In 1969 exports of minerals replaced coffee as the leading source of Angola's export receipts.[3] Diamond, iron ore, and most of the crude oil are produced for export; approximately one-fourth of the crude oil produced is processed in Angola. In 1968 diamond exports, all to Portugal, were valued at about $48 million. Iron ore exports were valued at about $23 million and were chiefly to Japan (1,725,939 tons) and West Germany (681,258 tons).

[1] Foreign mineral specialist (petroleum), Bureau of Mines, Washington, D.C.

[2] Where necessary, values have been converted at the rate of 1 escudo (Esc.) = US$0.035.

[3] Glad, A. L. Mineral Industries—Development and Outlook. State Department Airgram A-38, May 5, 1970, 6 pp. (This report provided information for several parts of this subchapter.)

Table 1.—Angola: Production of mineral commodities
(Metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969
METALS			
Copper, ore and concentrate, gross weight	-----	-----	5,350
Gold, metal, troy ounces	-----	9	12
Iron and steel: Iron ore and concentrate, thousand tons	1,154	3,218	5,478
Manganese, ore and concentrate, gross weight	33,180	9,150	29,070
NONMETALS			
Cement, hydraulic, thousand tons	279	312	333
Diamond:			
Gem, thousand carats	983	1,316	e 1,536
Industrial, do	306	351	e 486
Total, do	1,289	1,667	2,022
Gypsum	11,987	12,987	16,397
Salt, marine, thousand tons	78	72	80
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	27,043	30,603	39,284
Natural gas, associated [2], million cubic feet	22,594	6,000	NA
Petroleum:			
Crude oil, thousand 42-gallon barrels	3,880	[3] 5,401	[3] 17,441
Refinery products:			
Motor gasoline, do	497	560	524
Jet fuel, do	339	375	375
Kerosine, do	57	64	58
Distillate fuel oil, do	799	1,010	784
Residual fuel oil, do	2,415	2,361	2,593
Liquefied petroleum gas, do	102	111	85
Asphalt and bitumen, do	46	68	65
Total, do	4,255	4,549	4,434

e Estimate. NA Not available.

[1] In addition to the commodities listed, 35 tons of beryl and 1,810 tons of kaolin were also produced in 1969.

[2] Mostly flared; some used in oilfield operations.

[3] Includes production from Cabinda.

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Table 2.—Angola: Exports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Iron and steel:		
Ore and concentrate	780,619	2,451,422
Metal:		
Scrap	9,709	1,485
Semimanufactures	1,572	804
Lead, metal, scrap	295	500
Manganese, ore and concentrate	18,105	37,907
NONMETALS		
Cement	22,181	12,873
Diamond—thousand carats	1,316	1,505
Fertilizer materials, mineral	1,375	1,561
Gypsum and anhydrite	9,642	7,388
Salt	30,565	19,551
Stone, sand and gravel:		
Dimension stone:		
Granite	2,941	1,598
Marble	862	234
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products—thousand 42-gallon barrels	2,018	1,712

Table 3.—Angola: Imports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal	651	676
Copper, metal	r 568	557
Iron and steel:		
Oxide and hydroxide	122	132
Metal:		
Scrap	45	39
Pig iron and ferroalloys	393	507
Ingots and other primary forms	8,508	12,444
Semimanufactures	81,131	95,022
Lead:		
Oxide	27	54
Metal	299	290
Mercury—76-pound flasks	16	15
Silver—troy ounces	18,275	6,238
Titanium oxide	198	237
Tin—long tons	66	40
Zinc:		
Oxide	52	108
Metal	332	403
NONMETALS		
Abrasive materials, all types	67	87
Asbestos	1,447	558
Cement	9,669	6,588
Chalk	368	573
Clay and clay products (including refractory brick):		
Mineral	8,374	8,848
Brick, tile, etc.	164	152
Refractory brick, tile, etc.	195	250
Diatomite	180	155
Dolomite, calcined	43	51
Feldspar	45	20
Fertilizer materials: Manufactured:		
Nitrogenous	9,628	10,037
Phosphatic	5,892	4,686
Potassic	1,919	1,237
Mixed	4,025	10,277
Ammonia	74	125
Gypsum and anhydrite	131	62
Lime and limestone	106	98
Mica, unworked and worked	34	14
Pigments, mineral	33	66
Salt	44	43
Soda, caustic	2,756	2,780
Stone, sand and gravel: Dimension stone, all types	646	635
Sulfur:		
Elemental	252	250
Sulfuric acid	2,333	2,166
Talc and steatite	133	122
Nonmetallic minerals, crude, n.e.s.	120	282

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Table 3.—Angola: Imports of major mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity		1967	1968
MINERAL FUELS AND RELATED MATERIALS			
Carbon black		132	530
Coal and briquets		19,861	87,799
Coal tar and other distilled products		120	164
Coke and semicoke		552	465
Petroleum, refinery products:			
Gasoline	thousand 42-gallon barrels	62	62
Kerosine	do	57	62
Distillate fuel oil	do	581	1,096
Lubricants	do	97	11
Liquefied petroleum gas	do	20	18
Other	do	2	47
Total	do	769	1,296

r Revised.

COMMODITY REVIEW

Metals.—*Copper.*—Copper production was resumed during the year after a gap of 5 years. The output was from the Mavoio-Tetelo deposits near Maquela do Zombo, in northern Angola. The mining was by a new company, Sociedade de Investigacoes Mineiras (SIMEIRA), a joint venture comprised of Empresa do Cobre de Angola, the original concessionaire, and Société Anonyme du Chrome, a Swiss firm. SIMEIRA is required to invest at least $140,000 annually in exploration.

A concession was granted near Serpa Pinto, in south-central Angola, to Sociedade Mineira do Cubango. The company is mainly interested in copper, but it has rights to several minerals.

Gold.—Companhia Mineira do Lobito reported that the gold deposits on its concession in the M'popo area, south of Tchamutete, are valued at $20 million. They are scheduled to be in production in 1971 or 1972.

Iron Ore.—Iron ore development at the Cassinga mines continued at a steady pace, with production in 1969 rising about 70 percent over the 1968 total. The railroad used to transport ore from the mines to Port Salazar (formerly Moçâmedes), a distance of about 640 kilometers, was being renovated to enable the traffic to be increased; it was not designed originally to accommodate heavy loads. Port Salazar is to be improved so that it can accommodate 150,000-ton ships by 1970 and 200,000-ton ships by 1973. The port presently is capable of handling 100,000-ton ships and of loading at about 3,500 tons per hour.

Companhia Mineira do Lobito, which is controlled (85 percent interest) by the Portuguese Government, operates the Cassinga mines, the only ones producing. Kaiser Steel Corp., a United States firm, reportedly is interested in joining Lobito to develop the low-grade ore deposits at Cassinga.

During the year Lobito entered into a contract to supply six of Japan's largest iron and steel producers with 14 million tons of iron ore over an 8-year period. Substantial contracts were also being negotiated with Belgium, France, Italy, Spain, United Kingdom, and Eastern European countries.

The possibility of developing the iron ore deposits at Cassala was still under discussion during the year; a decision reportedly is to be made in 1970. The Cassala concession is held by Companhia do Man-

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ganes de Angola. Klöeckner Industrie-Anlagen G.m.b.H., a West German company, has done the technical studies for the project. Production from Cassala is envisaged at 1.8 million tons of pellets containing 65 percent iron.

Nonmetals.—*Cement.*—The capacity of the 300,000-ton-per-year cement plant of Companhis de Cimento Secil do Ultramar (Secil) was being increased during the year. It is expected to reach 600,000 tons per year by mid-1971. The expansion is intended to supply the growing domestic demand as well as a potential increase in the export market.

Diamond.—In 1969, diamond production, all from the Lunda District, rose by about 21 percent. The mining company, Companhia de Diamantes de Angola (DIAMANG), found a high-grade deposit (more than 2 carats per cubic meter) at Catoca, on the Lova Stream, a tributary of the Chicapa River, about 35 kilometers from Henrique de Carvalho.[4] The exploitation of the deposit is expected to increase the value of the company's production by about 50 percent. Other deposits were also found in the same region.

In 1971 DIAMANG's contract with the Government will expire and the company will have to release all but 50,000 square kilometers of its concession, which presently covers more than 80 percent of Angola. The company has increased its exploratory activity in order to find and retain the best areas in the present concession.

During the year four companies obtained diamond concessions: Diversa—Internacional de Exploração de Diamantes (about 27,500 square kilometers); Companhia de Diamantes Oeste Angola—OESTEDIAM (about 31,500 square kilometers); Diamul—Companhia Ultramarina de Diamantes (about 5,250 square kilometers); and Dianco—Companhia Nacional de Diamantes (about 16,500 square kilometers). The first three firms are controlled by U.S. interests, the fourth by South African.

Phosphate Rock.—Companhia dos Fosfatos de Angola continued to explore its Cabinda concession, received in 1968, and confirmed the existence of large, high-quality deposits. Before the deposits can be developed, an economical method of transportation must be found. Cabinda has no deep-water ports and offshore depths are shallow. A likely solution reportedly is to load ships from a pier or pipeline constructed several miles offshore. Development costs are estimated at a minimum of $50 million.

Mineral Fuels.—*Petroleum.*—Angola's petroleum reserves in 1969 included 645 million barrels of crude oil (of which 600 million barrels were in Cabinda) and 625 billion cubic feet of natural gas (500 billion cubic feet in Cabinda).[5] The crude oil reserves ranked about fifth in Africa.

Crude oil production increased sharply in 1969 due to a large output from Cabinda, which accounted for 12.3 million barrels, or about 70 percent of the total. Near yearend crude oil production in Cabinda averaged almost 50,000 barrels per day. Cabinda Gulf Oil Co., the producing company, expects production to reach 150,000 barrels per day in 1971 or 1972. In mid-1969 Angola had 86 producing oil wells, including 50 in Cabinda. All of Cabinda's production during the year was from offshore wells; the oil found onshore in 1968 was not produced. Elsewhere in Angola, the North Quenguela field, discovered in 1968, was an important producer.

The Government expected its oil revenues to reach $18.3 million in 1969, compared with $4.9 million in 1968.[6]

In January, Texaco Petróleos Angola received interests in the concessions held

[4] Engineering and Mining Journal. V. 170, No. 10, October 1969, p. 168.

[5] Oil and Gas Journal. V. 67, No. 52, Dec. 29, 1969, p. 95.

[6] Petroleum Intelligence Weekly. V. 8, No. 36, Sept. 8, 1969, p. 7.

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by Sociedade Portuguesa de Exploração de Petróleos (ANGOL) and Companhia de Petróleos de Angola (PETRANGOL). In the venture with ANGOL, Texaco received a 50-percent share in about 5,200 square kilometers of offshore area in northern Angola. In the venture with ANGOL-PETRANGOL, Texaco received a 25-percent share, the same as ANGOL, with PETRANGOL, holding the remaining 50 percent. The concession covers about 8,000 square kilometers both onshore and offshore, also in the north.

During the year a South African consortium acquired a 50-percent share in ANGOL's interest in onshore and offshore concessions. The principal members of the consortium are General Mining and Finance Corp. (30 percent); SA Nasionale Levensassuransiemaatskappy (21 percent); and Anglo-American Corporation of South Africa (18.75 percent).[7]

During the year new facilities were being added to the petroleum refinery at Luanda, Angola's only refinery, to raise its capacity from 14,000 barrels per day to 20,000 barrels per day by the end of 1970. The new facilities, which will cost about $5 million, are expected to increase the potential output to the following approximate totals:[8] Motor gasoline, 850,000 barrels; jet fuel, 640,000 barrels; kerosine, 130,000 barrels; distillate fuel oil, 1,900 barrels; residual fuel oil, 2,900 barrels; liquefied petroleum gas, 240,000 barrels; asphalt and bitumen, 150,000 barrels.

ANGOL continued discussions with the Government regarding the building of a refinery at Lobito with a capacity of up to 40,000 barrels per day.

MOZAMBIQUE

Minerals continued to have a minor role in Mozambique. Total production, excluding petroleum products, was estimated at $11 million.[9] Petroleum dominated the exploration scene; the first offshore drilling began late in the year. Although no oil was found, prospects are considered promising.

Work began on a more extensive scale on the Caborra-Bassa hydroelectric project after the Portuguese Government awarded a $246 million contract for the first phase of the project; the contract was provisionally awarded in 1968. The dam is expected to be completed in 1975. It will generate 18 billion kilowatts per year, part of which will be used to establish a mining industry in the region. The first priority probably will be electrofusion of about 4 million tons of magnetites per year to produce iron, titanium, and vanadium.[10] This would lead to an iron and steel industry near Tete.

During the year a Mozambique company, Gamor, signed a contract with the South African Federal Volksbeleggings Beperk regarding the exploitation of diamond, manganese, and asbestos in the Catuane region, near Swaziland.[11] In December, Johannesburg Consolidated Investment Co. and the Portuguese company of Leonel Gomes dos Santos received prospecting rights in eight areas totaling about 24,000 square kilometers in the Zambesi Basin, near Tete. The mineral rights exclude petroleum, diamond, iron ore, coal, and radioactive minerals.

PRODUCTION AND TRADE

The available data for mineral production and for trade of selected mineral commodities are as follows:

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[7] Petroleum Press Service. V. 36, No, 7, July 1969, p. 273.

[8] The Standard Bank Review (Johannesburg). No. 601, April 1969, p. 21.

[9] Where necessary, values have been converted at the rate of 1 escudo (Esc.)=US$0.035.

[10] Mining Journal (London). V. 274, No. 7019, Feb. 27, 1970, p. 173.

[11] Mining Journal (London). V. 273, No. 6994, Sept. 5, 1969, p. 201.

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Table 4.—Mozambique: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Aluminum, bauxite, gross weight	6,276	3,275	4,393
Beryllium, beryl concentrate, gross weight	169	94	122
Bismuth, mine output, metal content	2	2	3
Cesium, pollucite, gross weight	---	---	200
Columbium and tantalum: Ores and concentrates, gross weight:			
Columbite-tantalite	89	62	65
Microlite	70	90	83
Copper, ores and concentrate, gross weight	214	NA	NA
Gold, metal, troy ounces	22	6	NA
Thorium, monazite, kilograms	300	350	---
Tin, ore and concentrate, gross weight, long tons	446	---	(1)
NONMETALS			
Abrasives, natural, garnet [2], kilograms	1,021	9,012	NA
Asbestos	507	120	787
Cement, hydraulic [3], thousand tons	• 248	• 288	• 310
Clays:			
Bentonite (including montmorillonite)	4,631	3,818	4,432
Kaolin (including china clay)	577	350	262
Diatomite	5	209	120
Feldspar	120	100	NA
Gemstones, tourmaline, kilograms	4,128	866	1,340
Lime	7,648	NA	NA
Lithium minerals (mainly lepidolite)	250	748	418
Mica (mainly scrap)	100	336	NA
Quartz, kilograms	80,000	[4] 802,628	160,000
Salt, marine [5], thousand tons	38	18	• 7
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous, thousand tons	282	314	277
Petroleum, refinery products:			
Gasoline, thousand 42-gallon barrels	1,126	r 1,192	r 1,208
Distillate fuel oil, do	1,675	r 1,842	r 1,660
Residual fuel oil, do	2,108	r 2,405	r 2,315
Liquefied petroleum gas, do	56	r 78	r 87
Total, do	4,965	r [6] 5,587	r [7] 5,458

• Estimate. r Revised. NA Not available.
[1] Less than one ton.
[2] In 1968, 13,285 kilograms of industrial topaz was produced.
[3] Estimate based on data for 10 to 11 months.
[4] Includes 2,628 kilograms of quartz crystal.
[5] Includes 20 to 30 tons of rock salt annually except in 1968.
[6] Includes 75,000 barrels of asphalt.
[7] Estimate based on data for 10 months.
[8] Includes 188,000 barrels of asphalt.

Table 5.—Mozambique: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, bauxite and concentrate	• 6,200	• 3,000
Beryllium, beryl ore and concentrate	• 160	• 90
Bismuth, ore and concentrate, kilograms	• 1,000	• 1,000
Columbium and tantalum:		
Columbite-tantalite, do	• 75,000	• 60,000
Microlite, do	• 60,000	• 80,000
NONMETALS		
Clays and clay products, crude clays, montmorillonite	• 4,000	• 4,000
MINERAL FUELS AND RELATED MATERIALS		
Coal, bituminous and coke	73,411	NA
Petroleum refinery products:		
Gasoline, thousand 42-gallon barrels	915	773
Distillate fuel oil, do	1,082	8,286
Residual fuel oil, do	2,128	

• Estimate. NA Not available.

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Table 6.—Mozambique: Imports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Copper, metal, matte and wrought		[1] 893	NA
NONMETALS			
Fertilizer materials, manufactured		• 23,500	• 24,000
MINERAL FUELS AND RELATED MATERIALS			
Coal, coke and briquet		209,296	NA
Petroleum:			
Crude	thousand 42-gallon barrels	5,008	5,878
Refinery products:			
Gasoline	do	251	267
Kerosine	do	156	166
Residual fuel oil	do	420	681
Lubricants	do	70	78

• Estimate. NA Not available.
[1] Semimanufactures.

COMMODITY REVIEW

Metals.—*Nickel.*—Nickel was discovered in the Mangota Mountains, about 18 kilometers from Manica. A South African-Rhodesian consortium was evaluating the find.

Uranium.—Late in the year the West German firm of Urangesellschaft held discussions with the Portuguese Government regarding uranium exploration rights in Mozambique. Uranium prospecting in the country has been encouraging, particularly near Tete.[12]

Nonmetals.—*Cement.*—During the year Companhia de Cimentos de Moçambique began to expand the capacity of its cement plant at Matola, near Lourenço Marques, from 200,000 to 400,000 tons per year. The work is expected to be completed in 1971. The company also has a cement plant at Dondo (annual capacity of about 160,000 tons) and Nacala (90,000 tons). The demand for cement has risen because of a steady increase in construction.

Fertilizer Materials.—Plans were being discussed regarding the construction of an ammonia plant, possibly at Pande, about 160 kilometers south of Beira. The plan envisages utilizing the country's natural gas deposits. A plant capacity of 1,000 tons per day is considered necessary to make the project economically feasible. Financing probably would come from South African interests.

Mineral Fuels.—*Coal.*—During the year several Japanese steel companies imported on a trial basis a total of about 25,000 tons of fine coal from the Moatize coalfield.

Petroleum.—Offshore drilling began during the latter part of the year. Mozambique Gulf Oil Co., which jointly holds a concession with Pan American Oil Co., was drilling a 15,000-foot well in about 85 feet of water about 50 kilometers offshore at Nova Sofala. Sunray DX Oil Co., the operator for a group including Skelley Oil Co. and Clark Oil and Refining Co., was drilling a 12,000-foot well in about 100 feet of water off the mouth of the Limpopo River. No oil finds were reported. Geophysical surveys over the offshore areas reportedly indicate promising areas.

During the year the Aunt International Petroleum Co. of Mozambique was granted a 3-year concession in an area between Beira and Quelimane.[13] At least $2 million will be invested.

In 1969 the oil companies paid the Portuguese Government about $700,000 in concession fees.[14] The figure will rise to more than $1 million in 1970.

Mozambiquès natural gas reserves, estimated a 1 trillion cubic feet, are at Buzi, Pande, and Temane; all were discovered by Mozambique Gulf Oil Co. The commercial development of the gas may be forthcoming. Sociedade Moçambicana de Gases Comprimidos (MOGAS) plans to build a gas processing plant at Lourenço Marques, and Sociedade Nacional de Refinacao de Petroleos (SONAREP) and two other companies have formed a group to build a petrochemical plant.[15]

Work was underway during the year to increase the capacity of the refinery at

[12] World Mining. V. 5, No. 5, May 1969, p. 48.
[13] World Oil. V. 169, No. 3, Aug. 15, 1969, p. 181.
[14] International Commerce. V. 76, No. 8, May, 1970, p. 38.
[15] Source cited in footnote 13.

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Matola, near Lourenço Marques, from about 16,000 barrels per day to about 50,000 barrels per day by late 1970. The increase in output from the refinery, which is operated by SONAREP, will meet the rising export demand, particularly to Southern Rhodesia. Rhodesian demand for petroleum products from Mozambique has risen sharply since the United Nations Sanction caused the refinery at Umtali, Rhodesia, and the trans-Mozambique crude oil pipeline to shut down.[16]

PORTUGUESE GUINEA

No mineral developments were reported in 1969. Esso Exploration Guiné, Inc., has a concession covering the entire coastal area. Two offshore wells were drilled in 1968 and a third was being drilled in 1969. Apparently no petroleum was found.

[16] Petroleum Intelligence Weekly. V. 8, No. 32, Aug. 11, 1969, p. 8.

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The Mineral Industry of Argentina

By Robert A. Whitman [1]

The mineral industry of Argentina declined relative to the gross domestic product (GDP) during 1969. Detailed figures for value of production were not available, but preliminary data indicated a sharp drop in the value of mineral exports.

As a result of the steps taken to halt inflation and bolster the economy, the rate of increase in retail prices again declined, the GDP increased by nearly 7 percent, and unemployment decreased. Although the mining industry in Argentina still has a minor effect on the economy overall, the value of imports of mining machinery nearly doubled in 1969 over 1968. In August 1969 the Government announced five major investment projects of which three are related to minerals: Exploitation of the Sierra Grande iron ore deposits, construction of an aluminum reduction plant, and exploration and exploitation of copper deposits discovered in the San Juan-Neuquén area under the Plan Cordillerano. The iron project represents an investment of approximately $70 million, the aluminum reduction works with the attendant powerplant will require about $200 million, and the copper project, if proved feasible, will cost about $70 million. These projects should enlarge the mining industry and encourage other mining investment.

The only major mining legislation enacted during 1969 was law 18,274 of July 7, which specifically reserved several zones in the Provinces of San Juan and Neuquén for exploitation by the Direccion General de Fabricaciones. These zones encompass, principally, the copper prospects discovered under the Plan Cordillerano.

The Argentine Government continued studies to revise the Mining Code, but nothing was published.

[1] Physical scientist, Bureau of Mines, Washington, D.C.

Table 1.—Argentina: Selected economic indicators

Indicator	1967	1968	1969
Population at midyear, in thousands [1]	23,255	23,617	23,983
Gross national product (GNP): [2]			
Total GNP, in million 1968 dollars [3]	16,350	17,110	p 18,290
Percent change from previous year	+2.1	+4.6	+6.9
GNP per capita, in 1968 dollars	703	724	763
Index of industrial production (1963 = 100) [1]	103	140	150
Cost of living index (Buenos Aires), percent above that of previous year [1]	29.5	16.4	7.4
Cost of construction index (1960 = 100) [3]	563.4	606.2	663.7

p Preliminary.
[1] U.S. Agency for International Development (AID). Economic Data Book for Latin America—Argentina. August 1970.
[2] Converted at 350 pesos per U.S. dollar.
[3] Ministerio de Economia y Trabajo, República Argentina. Informe Economico. 4th Quarter 1969.

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PRODUCTION

Production of lead and zinc increased appreciably in 1969. Total output of manganese ore and concentrate remained about the same, but, there was about 4,000 tons less of the 30- to 40-percent grade which was made up by the increase in lower grade ores. Iron ore production increased about 8 percent. There was only a 1-percent increase in pig iron production.

Cement production increased 2 percent over that of 1968.

Production of natural gas declined about 2 percent; total sales of gas remained about the same. Production of crude petroleum increased 4 percent. Production figures for coal and coke were not available.

TRADE

In 1968 the value of exports of mineral commodities was about 3.5 percent of total export value, while minerals constituted 26.2 percent of the value of all commodities imported.

Detailed mineral export figures were not available by mid-1970, but mineral imports in 1969 as reported by the U.S. Embassy exceeded those of 1968 by 39 percent, excluding iron and steel products. This further eroded the favorable trade balance existing in 1967 and 1968, as shown in the following tabulation:

	Value (million dollars)	
	1967	1968
Exports:		
Mineral commodities:		
Metals	16.5	31.6
Nonmetals	2.2	3.1
Mineral fuels	8.9	13.7
Total	27.6	48.4
All commodities, total	1,464.5	1,367.9
Imports:		
Mineral commodities:		
Metals	198.2	193.2
Nonmetals	30.5	27.2
Mineral fuels	101.4	86.2
Total	330.1	306.6
All commodities, total	1,095.3	1,169.2
Net trade balance:		
Mineral commodities	−302.5	−258.2
All commodities, total	+369.2	+198.7

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Table 2.—Argentina: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1967	1968	1969 [p]
METALS				
Antimony, mine output, metal content		7	-------	-------
Beryl concentrate, gross weight		269	593	520
Bismuth, mine output, metal content	kilograms	78	3,125	-------
Columbite-tantalite, gross weight	do	3,000	-------	2,000
Copper, mine output, metal content		501	422	[3] 9,352
Gold, mine output, metal content	troy ounces	35	14	16
Iron and steel: [3]				
Iron ore and concentrate	thousand tons	226	277	300
Pig iron	do	604	574	580
Ferroalloys	do	18	NA	NA
Steel ingots	do	1,326	1,559	1,690
Semimanufactures (rolled product)	do	1,348	1,537	1,870
Lead:				
Mine output, metal content		[r] 32,299	[r] 26,670	34,914
Metal [4]		22,000	[r] 25,088	22,000
Manganese ore and concentrate, gross weight:				
30 to 40 percent manganese		26,356	27,060	23,057
Less than 30 percent manganese		10,179	3,941	8,520
Mercury	76-pound flasks	17	-------	-------
Silver, mine output, metal content	thousand troy ounces	1,697	2,422	NA
Tin, mine output, metal content	long tons	802	701	719
Tungsten, mine output, metal content		107	184	190
Uranium, mine output, U_3O_8 content	kilograms	28,238	42,688	NA
Vanadium, mine output, metal content		-------	-------	NA
Zinc:				
Mine output, metal content		[r] 27,250	[r] 26,323	31,680
Metal [4]		[r] 22,989	[r] 20,938	24,598
NONMETALS				
Abrasives, natural, n.e.s., garnet		95	65	55
Asbestos		500	346	78
Barite		22,052	16,178	25,000
Boron materials, crude		17,968	21,026	29,154
Calcite, nonoptical		6,866	5,960	8,822
Cement, hydraulic [3]	thousand tons	3,551	[r] 4,230	4,306
Chalk		45,034	56,426	55,469
Clays:				
Bentonite		42,459	46,652	52,813
Decolorizing clay		5,976	10,427	7,164
Kaolin		64,096	72,148	71,500
Refractory clay		115,375	114,549	130,327
Other	thousand tons	884	1,320	1,857
Diatomite		8,146	6,547	10,239
Feldspar		20,350	20,503	17,890
Fertilizer materials, crude natural phosphates (guano)		236	294	491
Fluorspar, all grades		19,255	19,895	22,415
Graphite		214	110	108
Gypsum, crude		264,653	371,031	470,000
Lithium minerals		247	127	NA
Mica:				
Sheet		136	94	NA
Waste and scrap		1,003	597	NA
Pigments, natural mineral, ochre		40	85	299
Quartz and quartzite:				
Common quartz		47,585	45,500	39,900
Quartzite		804,324	915,261	990,000
Glass sand		116,907	192,959	269,903
Salt, all types		857,611	740,200	700,000
Stone, sand and gravel, n.e.s.:				
Dimension stone:				
Marble and other calcareous		23,773	20,378	NA
Other, excluding quartzite:				
Flagstone		32,713	25,874	NA
Granite		9,909	12,441	NA
Sandstone		7,482	12,267	NA
Slate		6	-------	-------
Crushed and broken:				
Dolomite		198,018	138,632	NA
Limestone	thousand tons	9,491	10,896	12,300
Other calcareous, marble		57,491	53,304	NA
Rhodochrosite, including ornamental		206	159	119
Other, excluding quartzite:				
Granite	thousand tons	3,101	4,361	5,000
Miscellaneous		275,923	715,472	NA
Gravel	thousand tons	3,205	4,963	7,175
Sand, excluding glass sand	do	7,409	8,173	9,200
Strontium mineral, celestite		30	70	13
Sulfur, elemental, refined		32,796	[r] 34,223	34,509

See footnotes at end of table.

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Table 2.—Argentina: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969 [p]
NONMETALS—Continued			
Sulfates, natural:			
Aluminum (alum)	2,614	2,137	6,242
Iron (melanterite)	185	8	165
Magnesium (epsomite)	1,471	1,996	1,297
Sodium (mirabilite)	27,617	20,034	NA
Talc and related materials:			
Pyrophyllite	7,867	6,252	NA
Steatite	1,327	1,940	4,277
Talc	16,908	19,146	NA
Vermiculite	2,904	2,311	NA
Zeolites	43	52	45
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	3,857	1,326	2,583
Carbon black	[r] 20,487	[r] 21,974	24,000
Coal, all grades—thousand tons	411	[4] 471	NA
Coke, all types [7]	452	365	NA
Gas, natural:			
Gross production [8]—million cubic feet	228,419	249,486	243,741
Marketed [8]—do	169,257	188,806	189,499
Natural gas liquids:			
Natural gasoline—thousand 42-gallon barrels	600	537	155
Liquefied petroleum gases—do	1,098	1,299	1,208
Peat, agricultural	2,298	NA	NA
Petroleum:			
Crude oil—thousand 42-gallon barrels	114,673	125,488	130,033
Refinery products: [9]			
Gasoline and naphthas:			
Aviation gasoline—do	550	351	419
Motor gasoline and naphthas—do	30,643	30,198	33,275
Kerosine—do	6,714	6,281	6,427
Jet fuel—do	1,460	1,708	2,212
Distillate fuel oil—do	27,284	28,913	31,756
Residual fuel oil—do	53,030	54,188	55,234
Liquefied petroleum gas—do	2,845	3,456	4,209
Lubricants—do	875	961	953
Asphalt and bitumen, refinery—do	2,071	3,702	4,803
White spirit—do	282	228	NA
Solvents—do	398	391	498
Petroleum coke—thousand tons	435	436	NA
Refinery gas [8]—million cubic feet	11,115	9,615	NA

[p] Preliminary. [r] Revised. NA Not available.

[1] In addition to commodities listed, Argentina produces unreported amounts of cadmium metal, lime, perlite, pumice, and Thomas slag and urea for fertilizer use. Sporadic production of small quantities of chromite, corundum, molybdenite, and unspecified titanium minerals was reported during the period covered, but these commodities are not listed.

[3] Ore and concentrate.

[3] Metal and alloy data were compiled from statistics published by Instituto Latinoamericano del Fierro y el Acero, and exclude small quantities of foundry-produced crude steel and castings totaling approximately 15,000 to 25,000 tons per year.

[4] Estimates based on statistics compiled by American Bureau of Metal Statistics.

[5] Data include white and special cement as well as common portland cement.

[6] Excludes a relatively small quantity of usable but noncommercial washed coal.

[7] Coke and coke breeze produced by Sociedad Mixta Siderúrgia Aregentina (SOMISA), the principal producer.

[8] Converted from cubic meters at rate of 1 cubic meter equals 35.3145 cubic feet.

[9] Includes some products derived in part from natural gas and natural gasoline.

Source: Instituto Nacional de Geología y Minería and Dirección Nacional de Energía y Combustibles for most commodities. Principal exceptions are indicated in footnotes.

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Table 3.—Argentina: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum, metal, including alloys, all forms	10	68	Mainly to Peru.
Beryllium, beryl ore and concentrate	266	570	All to United States.
Cadmium	-------	24	Mainly to Netherlands.
Copper:			
Ore and concentrate [1]	194	282	Mainly to West Germany.
Metal, including alloys, all forms	12	421	Mainly to United States.
Iron and steel:			
Ingots and other primary forms	3,888	-------	
Semimanufactures:			
Bars and rods:			
Wire rod	35,574	89,198	United States 23,411; Uruguay 11,305.
Other	13,643	112,316	Mainly to United States.
Angles, shapes, sections	3,515	24,711	Do.
Universals, plates, sheets	1,857	2,116	Uruguay 1,122; Paraguay 751.
Wire	5,276	5,743	Paraguay 2,988; Brazil 2,269.
Tubes, pipes, fittings	38,289	55,992	United States 27,258; Bolivia 10,149; Kuwait 8,095.
Other	161	82	Mainly to Bolivia.
Lead:			
Ore and concentrate	660	633	United States 443.
Metal, including alloys, all forms	1	6	Mainly to Paraguay.
Silver, metal, thousand troy ounces	774	540	Mainly to United Kingdom.
Tantalite, kilograms	2,999	1,802	All to United States.
Tin:			
Ore and concentrate, long tons	4,118	4,648	All to United Kingdom.
Metal, including alloys, do	(2)	3	Mainly to Paraguay.
Tungsten, ore and concentrate	107	307	West Germany 160; United States 66.
Zinc, metal, including alloys, all forms	935	1,854	Mainly to Brazil.
Other:			
Ash and residues containing nonferrous metal	256	1,446	United Kingdom 762; Belgium 483.
Metals, including alloys, all forms, n.e.s.	2	29	Mainly to Netherlands.
NONMETALS			
Barite	55	1,263	All to Bolivia.
Boron materials, crude natural borates	158	200	All to Uruguay.
Cement	16,870	35,798	Paraguay 19,673.
Clays and clay products (including all refractory brick):			
Bentonite	5,350	10,471	Bolivia 5,365; Chile 2,410; Brazil 1,980.
Kaolin	42	22	Mainly to Uruguay.
Other	53	3	Mainly to Paraguay.
Fluorspar	345	981	Japan 500; Chile 408.
Gypsum and plasters	13,312	15,037	Mainly to Paraguay.
Lime	30	205	Mainly to Bolivia.
Mica, all forms	316	524	West Germany 300; Spain 150.
Onyx	60	108	Italy 68; United States 20.
Quartz	20	60	All to Chile.
Rhodochrosite, ornamental, kilograms	19,108	9,805	West Germany 4,205; Italy 2,500.
Salt	49,018	47,995	Uruguay 27,292.
Stone, sand, and gravel:			
Dimension stone	6,300	5,720	Mainly to Italy.
Dolomite	2,401	1,520	All to Chile.
Other	141	51	Paraguay 30.
Talc, steatite, soapstone, and pyrophyllite	125	60	All to Chile.
Other nonmetals	956	2,024	Uruguay 972; Paraguay 740.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	6,601	4,316	Paraguay 2,870; Bolivia 1,307.
Carbon black	4,268	5,294	Chile 2,272; Brazil 2,213.
Coal, all grades	50	2,164	Uruguay 1,450.
Gas, hydrocarbon, liquefied or not	1,712	995	Mainly to Paraguay.
Petroleum:			
Crude	9,239	187,971	Puerto Rico 113,575.
Refinery products:			
Gasoline, thousand 42-gallon barrels	108	5	Mainly to Paraguay.
Kerosine, do	(2)	(2)	Mainly to Bolivia.
Distillate fuel oil, do	(2)	1	Mainly to Brazil.
Residual fuel oil, do	4,901	5,920	Mainly to United States.
Lubricants	517	2,242	Mainly to Uruguay.
Other	4,421	54,407	Canada 28,106; Italy 13, 515.
Mineral tar and crude chemicals from coal, petroleum, and natural gas	730	301	Paraguay 200.

[1] Including concentrates containing significant amounts of silver.
[2] Less than ½ unit.

Source: Instituto Nacional de Estadística y Censos. Comercio Exterior. Part II, 1967 and 1968.

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Table 4.—Argentina: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum:			
Bauxite and concentrate	34,077	37,528	Mainly from Australia.
Oxide (alumina) and hydroxide	6,535	6,816	West Germany 4,482; France 1,225.
Metal, including alloys, all forms	31,211	41,550	Canada 8,992; United States 8,760; Norway 6,611; Ghana 6,449.
Antimony, ore and concentrate	492	283	Mainly from Bolivia.
Arsenic, trioxide	402	433	Belgium-Luxembourg 176; West Germany 140.
Bismuth, metal	18	17	Mexico 11.
Cobalt:			
Oxide and hydroxide	10	10	Belgium-Luxembourg 8.
Metal	60	71	Mainly from Belgium-Luxembourg.
Copper, metal, including alloys, all forms	17,152	20,104	Mainly from Chile.
Iron and steel:			
Ore and concentrate, thousand tons	880	616	Brazil 362; Chile 122.
Metal:			
Scrap, do	30	185	Mainly from United States.
Pig iron, including spiegeleisen, do	99	280	Brazil 74; U.S.S.R. 65; Finland 58; Peru 26.
Ferroalloys	2,346	2,808	Republic of South Africa 1,239; Brazil 244; Sweden 214; France 208.
Ingots and other primary forms, thousand tons	365	343	Venezuela 91; Brazil 82; United States 78; Poland 30; Canada 24.
Semimanufactures:			
Bars and rods, do	32	20	Italy 5; Austria 3; France 3; West Germany 2; United Kingdom 2.
Angles, shapes, sections, do	18	22	West Germany 6; United Kingdom 5; Belgium 4.
Universals, plates, sheets:			
Tinned plates and sheets, do	110	117	United Kingdom 40; United States 24; Japan 22.
Other coated plates and sheets, do	2	2	Mainly from United States.
Other (uncoated), do	280	190	Brazil 46; West Germany 45; United Kingdom 30.
Hoop and strip, do	13	13	United Kingdom 4; United States 4.
Rails and accessories, do	1	(1)	Mainly from Italy.
Wire, do	2	2	Do.
Tubes, pipes, fittings, do	13	7	West Germany 2; Mexico 1; United States 1.
Other, n.e.s., do	1	1	Mainly from United States.
Lead, metal, including alloys, all forms	552	1,870	Mainly from Belgium.
Manganese:			
Ore and concentrate	11,500	54,396	Mainly from Brazil.
Oxides	2,922	4,321	Mainly from United States.
Metals	18	38	Republic of South Africa 18; Japan 10.
Mercury, 76-pound flasks	248	165	Mainly from Mexico.
Nickel, metal, including alloys, all forms	448	572	Canada 206; United States 101; Norway 83.
Precious metals and alloys, unwrought and semimanufactures, troy ounces	87,771	95,230	Mainly from United States.
Rare-earth metals and compounds	16	10	France 3; United States 2; West Germany 2.
Selenium, elemental	7	9	Canada 5; Belgium 1.
Tin:			
Oxides, long tons	4	1	Mainly from United Kingdom.
Metal, including alloys, all forms, do	846	1,079	Mainly from Malaysia.
Titanium:			
Ore and concentrate	807	794	Mainly from Australia.
Oxides	2,101	1,100	West Germany 659; United Kingdom 174.
Zinc, metal, including alloys, all forms	2,498	4,480	Mainly from Canada.
Zirconium, ore and concentrate	842	844	Australia 478; United States 115.
Other:			
Ore and concentrate	52	332	Mainly from Republic of South Africa.
Metals, including alloys, all forms	274	269	Canada 113; United States 102.
NONMETALS			
Abrasives, natural, n.e.s	289	620	United States 268; Uruguay 200; Belgium 83.
Asbestos	14,436	16,629	Canada 11,420; Republic of South Africa 4,617.
Barite	20	70	United States 55.
Bromine	156	75	Mainly from Israel.
Cement	395	674	Italy 500; Chile 148.
Chalk	317	82	Mainly from Belgium.

See footnotes at end of table.

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Table 4.—Argentina: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS—Continued			
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Fire clay	337	268	West Germany 131; United Kingdom 58.
Kaolin	11,594	13,818	Mainly from United States.
Other	26	28	Mainly from West Germany.
Products:			
Refractory (including nonclay brick and cement)	24,532	17,911	Brazil 3,674; Greece 3,200; United States 2,961; Austria 1,782.
Nonrefractory	62	456	Mainly from Italy.
Diamond: [3]			
Gem—value	$6,266	$21,433	Mainly from Belgium.
Industrial—do	$55,627	$97,102	Belgium $61,907; United Kingdom $18,172.
Powder—do	$49,983	$43,742	Netherlands $26,114; United Kingdom $14,333.
Diatomite and other infusorial earths	2,724	2,174	Mainly from Mexico.
Fertilizer materials:			
Nitrogenous:			
Natural	9,690	7,738	Mainly from Chile.
Manufactured	66,755	36,125	Italy 13,795; West Germany 10,199; Netherlands 6,948.
Phosphatic	7,727	7,741	United States 5,642; France 1,000.
Potassic	7,592	10,909	United States 6,731; West Germany 3,529.
Mixed and nonspecified fertilizers	51,761	37,905	United States 16,672; West Germany 11,273.
Graphite, natural	231	372	Mainland China 135; West Germany 94.
Iodine	17	26	Mainly from Chile.
Kyanite, andalusite, sillimanite	558	202	India 120; United States 31.
Lime	-------	60	Mainly from Paraguay.
Lithium and lithium compounds	22	40	Mainly from United States.
Magnesite	2,718	4,560	Brazil 2,400; Austria 1,161.
Mica	12	20	United Kingdom 11.
Pigments, mineral	73	75	Mainly from Spain.
Sodium and potassium compounds, excluding salt:			
Caustic soda	11,028	5,594	United Kingdom 1,288; Italy 1,106; France 1,040.
Caustic potash	1,847	755	Italy 352; United States 198; West Germany 114.
Sodium carbonate	116,625	143,096	United States 59,692; Rumania 37,714; United Kingdom 23,737.
Stone, sand, and gravel:			
Dimension stone	2,935	8,710	Mainly from Italy.
Dolomite	17,314	12,271	Mainly from Uruguay.
Gravel and crushed rock—thousand tons	344	244	Uruguay 204.
Sand—do	604	922	Mainly from Uruguay.
Sulfur, elemental, all forms	21,031	22,468	Mainly from United States.
Talc, steatite, soapstone, and pyrophyllite	507	143	Brazil 50; France 30; Uruguay 20.
Other nonmetals, n.e.s.	27,031	487	Mainly from United States.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	266	192	Mainly from United States.
Carbon black	1,075	1,478	United States 934; West Germany 364.
Coal—thousand tons	807	521	Mainly from United States.
Coke—do	39	31	Italy 11; United Kingdom 8; West Germany 6.
Gas, hydrocarbon, liquefied or not—do	355	320	Venezuela 165; United States 44; Saudi Arabia 32.
Petroleum:			
Crude—do	2,288	1,782	Venezuela 633; Oman 631; Qatar 252.
Refinery products:			
Gasoline—thousand 42-gallon barrels	140	523	Netherlands Antilles 218; Puerto Rico 137; Brazil 118.
Kerosine—do	61	(1)	All from United States.
Distillate fuel oil—do	1,170	2,823	Puerto Rico 1,139; Venezuela 1,006.
Lubricants—thousand tons	74	65	Mainly from United States.
Other—do	r 193	6	Do.
Mineral tar and crude chemicals from coal, petroleum, and natural gas	51,958	36,692	Mainly from Venezuela.

r Revised.
[1] Less than ½ unit.
[3] Data on quantity incomplete or not reported.

Source: Instituto Nacional de Estadística y Censos. Comercio Exterior. Part III, 1967 and 1968.

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COMMODITY REVIEW

METALS

Aluminum.—In July 1969, the President of Argentina issued a formal Order in Council approving the establishment of an aluminum plant at Puerto Madryn, just over 1,000 kilometers southwest of Buenos Aires. The planned plant has a production target of from 140,000 to 150,000 tons per year of aluminum (starting in 1974) from imported alumina. Power for the reduction is to come from the Andean Futaleufu River system about 500 kilometers to the west.

Copper.—The Argentine Government gave notice that exploration permits of 5 years duration coupled with 50-year mining concessions would be awarded to successful bidders for the development of deposits of copper and molybdenum located in the Andean Provinces of Mendoza, Neuquén, and San Juan. These are the deposits found by the Plan Cordillerano survey sponsored jointly by the United Nations and the FM during the last 5 years.

Compania Minera Aguilar, S.A., produced a record 67,914 tons of zinc concentrate, and 46,680 tons of lead concentrate, from its mine and mill in northern Argentina. Most of the zinc concentrates were smelted and refined in Argentina by Compania Metalurgica Austral at Comodoro Rivadania and Compania Sulfacid (near Rosario) after the payment of 10 percent royalty to the Province.

Iron and Steel.—The production of iron and steel products reached a new high in 1969. This resulted from such factors as the improved economic situation, increased activity from large investments and from public works, and greater production capability. The production of crude steel, however, barely exceeded that of 1968 and was appreciably less than that for 1965, still the year of record ingot production. Pig iron production was reduced by repair time on the blast furnace of the Sociedad Mixta Siderúrgia Argentina (SOMISA) in January and by a 2-month interruption during July and August while the same blast furnace was completely relined. Innovations introduced during relining enabled SOMISA to set a new monthly record of 68,100 tons for the production of steel ingots during November. The following tabulation shows the increase in production of ingot steel and steel manufactures during the period from 1967–69, in thousand metric tons.

Product	1967	1968	1969 p
Pig iron	596.5	578.6	580.6
Crude steel	1,327.6	1,555.7	1,696.6
Finished steel sheets:			
Flat	539.8	706.9	833.3
Non-flat	714.0	953.5	1,046.2
Seamless tubes	94.4	117.6	128.2

p Preliminary.

The total apparent consumption of steel reached 3.3 million tons in 1969, the most for any year to date. Although there was a slight increase in stocks, real consumption still would be a record. The lack of a corresponding increase in pig iron production made increases in the imports of sheet steel necessary. This adversely affected the balance of payments. However, exports of about 10 percent of the production of iron and steel products helped to offset this.

Several projects aided in the effort to become self-sufficient in steel. As mentioned, SOMISA introduced improvements in the lining and blowers of its blast furnace to increase its normal capacity to 167,000 tons per year. SOMISA also added oxygen lancing and provisions for use of more hot metal per charge to increase the output of its Siemens Martin steel furnace. Altos Hornos Zapla increased its capacity by working its Thomas converter in duplex.

Industria Argentina de Aceros, S.A. (ACINDAR) increased its annual capacity by 30,000 tons. Dalmine Siderca, S.A., put a third 50-ton electric furnace on stream during the second quarter. Establecimentos Metalurgicos Santa Rosa, S.A. reached full capacity in output from its third 50-ton electric furnace. Talleres Metalurgicos San Martin, S.A. started operating a new 45-ton Siemens Martin furnace in May. Technical improvements were made in furnaces of La Cantabrica S.A.M.I.y.C. and FM.

Some of the governmental decrees affecting the iron and steel industry in 1969 follow:

Decree 8304, December 12, 1968, allowed FM to increase its imports of hot-rolled or cold-rolled iron or steel sheets, containing up to 0.25 percent carbon, up to 200,000 tons, free of customs duties. FM was also pardoned its debts due to sales taxes and is exempted from such taxes until 1973.

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Decree 539, February 28, 1969, approved of the plan for Cura Hermanos to enlarge their capacity to 50,000 tons of crude steel and their rolling mill capacity from 60,000 to 120,000 tons.

Several other decrees authorized various steel companies to expand their plants, granted credits, issued import permits, or extended time for previously authorized plans for expansion.

The Ninth Latin American Steel Congress was held in Buenos Aires from September 29 to October 2, 1969. A total of 21 papers were presented by experts from various steel-producing countries, including the United States, Japan, Great Britian, and Germany. The principal topics discussed were the use of oxygen in steelmaking, new product development, and automation. Several papers emphasized the problems of small and medium-sized steel producers.

Iron Ore.—Decree 4045, July 25, 1969, approved the project for exploiting the iron ore in the Sierre Grande deposits. FM was charged with the formation of a company or entity to develop the ore, install a plant for the preparation of 2 million tons of pellets annually at Punta, Colorado in the Gulf of San Matias, and erect all necessary supporting machinery and transportation. Total cost of the project is estimated at $70 million. Phase 1 of the project calls for initial investment of $50 million for opening of the mine, construction facilities, water and gas pipelines, and bulk-loading facilities at Puerto, Colo. About $38 million of the phase 1 cost is to be furnished by private "national and foreign capital," most probably the contractors and suppliers.

NONMETALS

Cement.—Nearly 332,000 tons more cement was imported into Argentina in 1969 than in 1968 to help sustain the building program of the expanding economy. Rumania funished nearly 122,000 tons and Colombia, Chile, Peru, and Venezuela furnished 109,900 tons.

Rated installed capacity was increased only 2.8 percent over that of 1968, and actual production figures showed utilization of only 84 percent of the capacity for production. Installed production capacity was increased by 60,000 tons in Buenos Aires Province, by 48,000 tons in Chubut Province, and by 34,000 tons in Salta Province.

The Federal Capital and the Provinces of Buenos Aires, Cordoba, Mendoza, and Santa Fe consumed 82 percent of the cement sold in the country. Since 1961 the employment in the cement industry has remained fairly constant, varying only from 7,400 to 7,100 workers, but the total of salaries and wages paid has risen from 1,159 million pesos in 1961 to 7,842 million pesos in 1969.

Sulfuric Acid.—Although production of sulfuric acid has remained fairly constant during the last decade, the industry has changed from the use of several old chamber-process plants to fewer but larger contact-process plants. In 1969 there were seven plants with a combined capacity of about over 200,000 tons. Operators of the plants, with their locations and capacities, follows:

Operator	Location	Capacity Tons per year
Fabricaciones Militares (FM)	Berisso	28,000
Do	Rio Tercero	13,000
Compania Quimica	Avallaneda	14,000
Sulfacid	San Lorenzo	35,000
Industrias Quimicas Argentinas Duperial	----do	72,000
National Commission for Atomic Energy	Malargue	5,000
Petrosur, S.A.	Campana	89,500
Total		201,500

Source: Sulphur, January–February 1969. No. 80, pp. 19–20.

MINERAL FUELS

Discovery of the new Caimancito field in the Northwest Basin was probably the outstanding event in 1969 for the Argentine national oil company, Yacimientos Petrolíferos Fiscales (YPF). The first commercial producing well in Jujuy Province, Caimancito X–1, was drilled into the Yacoraite Formation. It is also the first successful well drilled into this deep Cretaceous horizon. Both the discovery well and outpost well X–2 had exceptionally high productivity and have outlined a proven area of over 2,000 acres. This discovery also opens new possibilities for the adjoining Salta Province. Since the new field is only a few miles from the Campo Duran-Buenos Aires trunk gasline, full utilizaton of the gas associated with the field will be possible with a minimum of capital investment for new pipeline.

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Macueta X–1 is another discovery in the Northwestern Basin. Although less productive than the Caimancito wells, it is producing from the Devonian formation and opens up new horizons for exploration not only in Salta Province but along the San Antonio Range.

Discovery well LPEM 246, the first producer ever drilled in the Province of La Pampa, is now considered an extension of El Medanito field in Río Negro Province.

Since 1967, when YPF reorganized and began to devote most of its resources to exploration, it has made several interesting discoveries in the Provinces of Jujuy, Río Negro, Neuquén, La Pampa, Mendoza, Salta, Santa Cruz, and Tierra del Fuego. In 1968 about 6 percent of the party-months of exploration was by private industry, and by 1969 participation by private industry was up to 10 percent, mostly in reflection seismic surveys. The following tabulation outlines the time spent on exploration and summarizes the subsequent drilling:

	Party-months of geologic and geophysical exploration in Argentina		
	1967	1968	1969
Geologic and geophysical exploration:			
Surface geology	66.0	84.0	100.0
Seismic mapping	264.0	294.0	287.1
Gravimeter	12.0	12.0	12.0
Topography	108.0	108.0	108.0
Air magnetometer	-----	[1] 28.0	1.8
Drilling:			
Producers completed	399	324	248
Dry holes completed	97	91	88
Footage drilled (thousand feet)	2,876	2,314	2,202
Average number rigs active	34	39	25

[1] Flight days.

Source: American Association of Petroleum Geologists Bulletin. V. 52, No. 8, 1968; v. 53, No. 8, 1969; v. 54, No. 8, 1970.

The first wildcat to be drilled by private industry under the concessions granted in 1968 by Petroleum Law 17319 was started in April 1969 and reported bottomed in basement in May at 5,292 feet. Private oil companies drilled and abandoned four more wells in 1969, all but one offshore.

Development and outpost drilling was confined to YPF; YPF crews drilled 176 wells, contractors working for YPF drilled 38, and the other 122 wells were sunk by companies holding development contracts with YPF. Total production of crude oil for 1969 was up about 4 percent over 1968, with the major producing basins being the San Jorge, Cuyo (Mendoza), and Neuquén. Gas production decreased slightly.

In February 1969 the Government of Agentina invited tenders for two exploration and/or exploitation areas. Bermejo area in San Juan Province covered 14,150 square kilometers (5,462 square miles), and Ramblones area in Mendoza and San Juan covered 10,350 spuare kilometers (3,995 square miles). Each area was divided into three blocks. On September 12 awards were made as follows: Bermejo No. 1, 3750 square kilometers to Cities Service; Bermejo No. 2, 5,050 square kilometers to Shell; Bermejo No. 3, 5,350 square kilometers to Shell; Ramblones "C", 3,300 square kilometers to Cities Service. Bids on Ramblones "B" block were not accepted, and no bids were tendered for Ramblones "A."

Ker-McGee Corp. relinquished its concession on Block 1 in the Samborombon area. Gulf Oil Corp. joined with Signal and Astra in the Rio Salada area, reducing the size of the concession area to 307,171 hectares by releasing part of the southwest sector. The last three blocks in the Gulf of San Jorge offshore area were awarded to YPF in 1969. Three new areas totaling 790,925 hectares in the Northwest Basin were reserved for YPF.

Argentina's refineries are being modernized and expanded. YPF has seven refineries contributing about 60 percent of Argentina's total capacity; eight refineries operated by private companies handle the rest of the crude oil processed. YPF greatly expanded the production of its refineries at Lujan de Cuyo near Mendoza and at La Plata. Shell, Esso, La Iseura,

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and Lottero y Papini were also expanding capacities of their refineries.

New pipelines to transport gas, crude oil, and petroleum products are being built throughout Argentina. A 412-mile products line was completed from Lujan de Cuyo to Cordoba early in 1969. A new line linking the Condor-Cerro Redondo gasfields with the Pico Truncado gasline to Buenos Aires is planned. Another gasline from Neuquén will tie in to the Pico Truncado-Buenos Aires gasline at Bohia Blanca.

Table 5.—Argentina: Production of crude oil and natural gas by Province

Province	Crude oil (thousand barrels)			Natural gas (million cubic feet)		
	1967	1968	1969	1967	1968	1969
Santa Cruz	34,148	35,884	33,910	105,073	117,663	NA
Mendoza	34,251	37,117	37,447	3,563	3,643	NA
Chubut	19,499	21,847	23,762	15,440	15,543	NA
Río Negro	15,797	17,274	20,365	9,798	11,209	NA
Salta	4,149	4,216	8,766	79,315	83,863	NA
Neuquén	4,357	7,189	7,947	12,854	15,526	NA
Tierra del Fuego	2,474	1,955	1,905	2,376	2,038	NA
La Pampa	-------	6	279	-------	-------	NA
JuJuy	-------	-------	652	-------	-------	NA
Total	[1] 114,673	125,488	130,033	[1] 228,419	249,486	243,741

NA Not available.
[1] Data may not add to totals shown because of independent rounding.

Source: American Association of Petroleum Geologists Bulletin. V. 54, No. 8., 1970.

On November 28, the Government approved application by The Dow Chemical Co. for a $99 million petrochemical complex to be built at Bahia Blanca. This is the largest petrochemical complex ever planned in Argentina and the first project approved under the new petrochemical promotion law (law 4271). The proposed products with the installed annual capacity follow:

	Metric tons
Ethylene	120,000
Ethylene and propylene oxides	25,000
Ethylene and propylene glycols	30,000
High-density polyethylene	20,000
Vinyl chloride monomer	50,000
Chlorine	90,000
Chlorinated solvents	20,000
Caustic soda	100,000

There is a great amount of construction in the petrochemical industry, but apparently the only capacity actually to come on stream during 1969 was at Cohoclor Industries Quimicas S.A.S.C, where new production was installed for 2,500 tons annually of methyl isobutyl ketone and methyl isobutyl carbinol, 2,500 annual tons of acetic anhydride, and 2,400 tons of isopropyl acetate, along with secondary butyl and methyl isobutyl carbinol.

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The Mineral Industry of Australia

By Lester G. Morrell [1]

Following the trend of more than a decade, new production records were set in 1969 for the Australian minerals industry as a whole and for many individual commodities. According to preliminary estimates, the total value of minerals produced during the year approximated $1.23 billion,[2] an increase of nearly 29 percent over the previous high of $958 million recorded in 1968. Including the value added by smelting and other primary forms of treatment, the value of Australia's metal and mineral product is estimated at over $1.6 billion in 1969, compared with $1.3 billion in 1968. In relation to the national economy, value of minerals produced and initially processed in Australia during 1969 represented 5.2 percent of the $32 billion adjusted gross national product (GNP). And the mineral output index (based on 1959=100) approximated 280 in 1969, compared with 179 and 219 in 1967 and 1968, respectively.

Of the more than 60 commodities that comprise Australia's mineral resource diversity, 25 recorded substantial increases in production during the past year. Among these were bauxite and alumina, bituminous coal, iron ore, copper, lead, manganese ore, nickel in concentrates, petroleum, silver, tin, ilmenite and rutile, zinc, and zirconium concentrate.

In 1968, the most recent year for which detail value estimates are available, 10 commodities accounted for over 82 percent of the total value of minerals produced. The leaders in order of value, in millions of dollars, were bituminous and subbituminous coal, $211.3; iron ore concentrates and pellets, $147.9; copper ores and concentrates, $103.4; lead ores and concentrates, $100.5; bauxite, $67.0;[3] crude petroleum, $43.9; zinc ores and concentrates, $33.7; titanium (rutile and ilmenite) concentrates, $29.0; gold bullion, $27.3; and brown coal, $24.1. The value added by domestic smelting and refining of the more important metallic raw materials (copper, lead, zinc, tin, iron, and aluminum) amounted to $380 million in 1968.

New South Wales retained its role as Australia's leading mineral State, accounting for 34.9 percent of the national mine output in 1968. The recent substantial increases in value of iron ore, petroleum, nickel ores, and bauxite in Western Australia raised that State to second place with 22.9 percent in 1968. Queensland contributed 21.7 percent; Victoria, Tasmania, and South Australia contributed 6.7, 5.4, and 5.0 percent, respectively.

Since 1959, the value of Australian mineral product exports has increased more than fivefold. Estimates of mineral commodity trade in 1969 indicate exports about 37 percent higher than the 1968 level. Major increases are attributed to iron ore and pellets, iron and steel products, coal, lead, zinc, copper, bauxite, alumina and aluminum metal, and beach sand concentrate products. Approximately half of Australia's mineral exports went to Japan. Australian mines are now Japan's principal foreign supplier of iron ore and on the basis of existing contracts, it is likely that Australia will soon become Japan's principal supplier of alumina, coal, lead, and zinc.

The dynamic pace of mineral search and development activities has continued through 1969. Among the more important new discoveries were the Snapper gasfield in Bass Strait off Victoria, and several promising nickel finds in Western Australia. New capital expenditures by mining

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[1] Mining engineer, Bureau of Mines, Washington, D.C.

[2] Unless otherwise indicated, values have been converted from Australian dollars (A$) to U.S. dollars at the rate of A$1=US$1.12.

[3] Values of bauxite and alumina production are not given in Australian statistics. A nominal value, based on United States price, f.o.b. mines, has been applied.

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and metallurgical "industry" in 1968 totaled $590 million, compared with $517 million in 1967. Private and Government expenditure on minerals exploration (other than that for petroleum) was $65.3 million in 1968, compared with $44.1 million the previous year. The Government's share in each year was slightly in excess of 10 percent. Respectively, 44 percent and 25 percent of the total exploration expenditure was in Western Australia and Queensland. Petroleum exploration activities, on shore and offshore, in 1968 involved private enterprise expenditure of $138 million ($99 million in 1967). Approximately half of this was in Bass Strait, off the south coast of Victoria, and one-fourth was in the coastal regions of Western Australia.

PRODUCTION

Impressive increases were recorded in most of the metallic and mineral fuels produced in Australia during 1969. Quantities of nonmetallic products, on the whole, continued at about the same level.

Table 1.—Australia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Aluminum:			
Bauxite	r 4,243,506	4,960,986	7,917,000
Alumina	854,420	1,309,461	1,931,022
Refined metal	92,792	97,348	126,420
Antimony (in antimony and lead concentrates)	945	844	846
Beryl	56	15	2
Bismuth (in ore)kilograms	11,583	176,182	214,386
Cadmium, refined metal	524	472	571
Chromite	140	---	---
Cobalt (in zinc and nickel concentrate)	148	215	e 300
Columbium and tantalum concentrates	r 36	108	73
Copper:			
Ore and concentrate (content)	r 93,173	109,216	130,040
Blister (primary)	71,963	93,938	115,582
Refined (primary)	67,154	85,622	100,967
Goldtroy ounces	r 805,336	787,042	716,089
Iron and steel:			
Iron orethousand tons	r 17,158	26,345	39,096
Pig irondo	5,057	5,572	6,107
Ferroalloys: [1]			
Ferrochromium, high carbon	2,217	2,512	NA
Ferromanganese and silicomanganese	76,318	52,009	NA
Ferrosilicon	8,948	10,213	NA
Steel ingots and castingsthousand tons	r 6,266	6,502	7,017
Steel semimanufactures [1]do	r 5,556	6,349	NA
Lead:			
Ore and concentrate (content)	r 381,810	388,921	445,329
Refined (primary)	193,926	178,045	189,536
Bullion, for export	102,791	117,997	154,358
Manganese ore, metallurgical grade	r 568,954	745,867	921,869
Nickel, in ore and concentrate	2,094	4,646	10,797
Selenium (in refinery slimes) ekilograms	2,000	2,500	3,000
Silver:			
Ore and concentrate (content)thousand troy ounces	r 19,842	21,419	24,667
Refineddo	r 9,917	9,613	9,749
Tin:			
Ore and concentrate (content)long tons	5,600	6,650	8,013
Smelterdo	3,594	3,692	4,156
Titanium concentrates:			
Ilmenite (includes leucoxene)	r 553,658	564,887	e 712,200
Rutile	r 269,775	293,573	359,318
Tungsten ores and concentrate (W content)	963	1,156	1,250
Uranium oxide (U_3O_8) e	300	300	300
Zinc:			
Ore and concentrate (content)	r 406,955	422,389	504,625
Smelter	197,593	208,282	246,324
Zirconium concentrate	r 288,235	319,938	372,873

See footnotes at end of table.

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Table 1.—Australia: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
NONMETALS				
Asbestos		666	812	718
Barite		15,917	39,826	33,504
Cement	thousand tons	r 3,829	3,928	4,310
Clays:				
Bentonite and bentonite clay		363	308	e 320
Brick clay and shale	thousand tons	r 5,787	6,491	e 6,000
Cement clay and shale	do	162	258	NA
Damourite clay		498	493	e 500
Fire clay	thousand tons	r 243	300	e 300
Kaolin and ball clay	do	67	60	e 60
Other	do	539	798	NA
Diatomite		r 11,281	6,833	3,404
Feldspar		4,521	4,916	4,760
Fertilizer materials, phosphate rock		11,959	5,836	NA
Fuller's earth		76	76	e 75
Gem stones e	value, thousands	r $5,158	$7,365	NA
Gypsum		r 928,755	859,421	868,601
Lime [1]		190,592	214,819	e 210,000
Lithium minerals [2]		678	750	721
Magnesite		24,033	23,517	23,544
Monazite concentrate		2,313	2,075	3,989
Pyrites, including cupreous pyrite		256,805	167,918	119,629
Salt	thousand tons	714	952	e 1,000
Talc and soapstone		r 20,995	39,065	41,000
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Bituminous [4]	thousand tons	35,265	40,829	46,181
Lignite (brown coal)	do	23,759	23,340	23,226
Coke:				
High-temperature	do	3,695	3,955	4,451
Low-temperature [5]	do	626	635	e 650
Fuel briquets	do	1,875	1,578	1,487
Natural gas	million cubic feet	152	216	9,387
Petroleum:				
Crude	thousand 42-gallon barrels	7,600	13,877	15,805
Refinery products:				
Gasoline	do	52,826	56,397	58,940
Kerosine and jet fuels	do	7,232	8,248	8,474
Distillate fuel oil	do	25,844	28,850	31,831
Residual fuel oil	do	40,737	44,728	38,913
Lubricants	do	2,291	2,402	2,258
Other products	do	8,591	6,676	10,181
Refinery fuel and loss	do	13,415	16,288	15,340
Total	do	150,936	163,589	165,937

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Ferroalloys and steel semimanufactures are reported for fiscal years ending November 30.

[2] Year ended June 30 of year stated.

[3] Petalite, amblygonite, and spodumene.

[4] Includes semianthracite and subbituminous.

[5] Includes coke breeze.

TRADE

The following trade data, provided by Commonwealth Bureau of Census and Statistics, cover the official July 1–June 30 annual reporting period, hence are not comparable with calendar year data presented elsewhere in this review.

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Table 2.—Australia: Exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1966–67	1967–68	Principal destinations, 1967–68
METALS			
Aluminum:			
Alumina [2]—value, thousands	NA	$67,704	NA.
Scrap	1,388	1,205	Japan 956; Netherlands 143.
Unwrought	19,116	7,047	Hong Kong 2,123; Philippines 1,970; New Zealand 825.
Semimanufactures	11,325	5,899	Canada 3,365; United States 769.
Beryllium ore and concentrate	604	66	United States 39.
Cadmium, refined metal [3]	682	16	United States 6; India 2; United Kingdom 2.
Copper:			
Ore and concentrate, gross weight	38,924	48,014	All to Japan.
Blister, cement, etc	7,858	6,638	Do.
Scrap	77	513	All to Netherlands.
Ingots, blocks, billets	3,666	12,685	United States 5,083; Japan 3,533; United Kingdom 3,022.
Semimanufactures	6,162	6,124	New Zealand 4,300; Philippines 631.
Pipe, tubes, and wire	1,893	870	New Zealand 562; Singapore 79.
Gold:			
Ore and concentrate, content [3] troy ounces	r 132,932	116,575	Mainly to Japan.
Crude bullion, content—do	61,280	15,831	Mainly to United Kingdom.
Mint bullion—do	348,653	60,839	Mainly to Hong Kong.
Sheet, strip, dust—do	166,481	424,641	Hong Kong 419,419.
Iron and steel:			
Iron ore and concentrate thousand tons	5,556	12,524	Japan 10,915.
Scrap	409,597	429,940	Japan 397,260.
Pig iron	131,834	185,865	Japan 149,433.
Steel ingots, blooms, slabs, etc	371,294	348,986	Philippines 93,824; Spain 55,549; Hong Kong 51,303.
Steel semimanufactures	810,868	594,295	New Zealand 206,688; United States 63,412; United Kingdom 61,962.
Lead:			
Ore and concentrate, gross weight	110,743	115,320	Japan 30,923; United States 28,447; United Kingdom 25,614.
Refined, unwrought	154,586	153,465	United Kingdom 63,920; United States 49,069; India 19,780.
Bullion, lead and silver-lead	82,214	108,473	United Kingdom 91,245.
Semimanufactures	3,462	3,994	New Zealand 2,145; Philippines 918.
Manganese ore	275,881	400,044	Japan 309,125.
Platinum metals [4]—troy ounces	55,181	3,671	Hong Kong 2,555; New Zealand 634; United Kingdom 447.
Silver:			
In lead bullion and concentrates, content [3]—thousand troy ounces	10,106	11,272	Mainly in lead bullion to United Kingdom.
Mint bullion—do	2,182	10,320	United Kingdom 6,803; Japan 3,480.
Sheet, strip, dust—do	543	1,036	Japan 880.
Tantalite-columbite concentrate	28	55	United Kingdom 33.
Tin:			
Ore and concentrate, gross weight long tons	2,560	3,886	Malaysia 1,564; Japan 976; United States 463; Spain 425.
Unwrought—do	16	193	New Zealand 72; Italy 50; Papua and New Guinea 22.
Titanium concentrates:			
Ilmenite, minimum 45 percent TiO_2	388,472	413,482	United Kingdom 195,240; France 100,185; Japan 57,721.
Rutile, minimum 90 percent TiO_2	248,469	267,131	United States 137,517; Japan 30,088.
Tungsten concentrates:			
Scheelite	1,175	1,268	West Germany 529; Netherlands 315; United Kingdom 256.
Wolframite	480	368	Japan 90; United States 75; United Kingdom 57; West Germany 56; Republic of South Africa 55.
Zinc:			
Ore and concentrate, gross weight	254,519	316,436	United Kingdom 177,335; Japan 95,811.
Ingots, blocks, slabs, etc	115,868	90,566	India 22,676; United States 12,000; Thailand 10,146.
Semimanufactures	439	828	New Zealand 397; Iran 305.
Other forms	2,109	3,317	Japan 1,834; Malaysia 588.
Zircon concentrate, minimum 30 percent $ZrSiO_4$	237,142	254,933	Japan 57,469; United States 52,846; United Kingdom 36,837.

See footnotes at end of table.

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Table 2.—Australia: Exports of mineral commodities [1]—Continued
(Metric tons unless otherwise specified)

Commodity	1966–67	1967–68	Principal destinations, 1967–68
NONMETALS			
Abrasives:			
Industrial diamonds [4]—carats	40,194	40,512	United Kingdom 17,924; Philippines 9,590.
Other natural abrasives, value, thousands	$76	$81	Japan $27; Philippines $25.
Asbestos, crude and fiber [5]	8,736	722	Malaysia 598; Papua and New Guinea 118.
Cement, construction types	2,124	16,745	Ceylon 11,801; Fiji 3,111.
Clays, fire, sillimanite, and others	3,323	4,177	Japan 2,353; United Kingdom 921; Papua and New Guinea 639.
Gem stones:			
Diamonds [4]—carats	1,615	1,628	Belgium-Luxembourg 707; United Kingdom 367; Israel 206; United States 177.
Opal—value, thousands	$8,122	$7,508	Japan $2,697; Hong Kong $2,576; United States $1,005.
Other, cameo, intaglio—do	$1,864	$2,407	United States $1,242; Japan $416; United Kingdom $302.
Gypsum	242,706	214,574	New Zealand 81,812; Taiwan 54,629; Philippines 35,855.
Magnesite	1,879	1,781	United States 737; New Zealand 408.
Monazite concentrate [5]	1,858	2,616	Mainly to United States.
Salt	94,382	168,825	Japan 153,596.
Talc and steatite	5,418	17,558	Netherlands 12,029; Belgium-Luxembourg 3,073.
MINERAL FUELS AND RELATED MATERIALS			
Coal—thousand tons	8,946	10,363	Japan 10,014; New Caledonia 186; Taiwan 110.
Coke and semicoke	81,349	289,714	Japan 165,988; New Caledonia 109,045; New Hebrides 12,705.
Petroleum refinery products:			
Gasoline, total, thousand 42-gallon barrels	1,150	2,004[e]	New Zealand 1,460; Singapore 365.
Kerosine and jet fuel—do	456	974	New Zealand 571; Fiji 188.
Distillate fuel oil—do	2,957	1,615	New Zealand 620; Republic of South Africa 255.
Residual fuel oil—do	3,275	3,218	New Caledonia 1,254; Singapore 869; Japan 685.
Lubricants—do	648	676	New Zealand 175; Singapore 143; Philippines 140.
Other products—do	327	226	New Zealand 135; Fiji 52.

[r] Revised. NA Not available.
[1] Periods shown are fiscal years July 1 to June 30.
[2] Quantities given are for 1967 and 1968 calendar years, respectively.
[3] Data not available on quantities of cadmium exported in lead and zinc concentrates.
[4] Includes reexports.
[5] Mostly crocidolite.

Table 3.—Australia: Imports of mineral commodities [1]
(Metric tons unless otherwise specified)

Commodity	1966–67	1967–68	Principal sources, 1967–68
METALS			
Aluminum:			
Scrap	1,228	1,202	New Zealand 493; Canada 268; United States 192.
Pigs, ingots, blocks, etc	452	1,362	United States 877; United Kingdom 408.
Semimanufactures	3,053	2,034	United Kingdom 724; United States 557; West Germany 498.
Pipes, tubes, powder, wire	904	706	United States 396; United Kingdom 89; Sweden 87.
Antimony metal	20	2	NA.
Arsenic trioxide	1,523	1,893	Sweden 1,158; France 593.
Bismuth metal	7	12	Japan 4; United Kingdom 4.
Chrome ore and concentrate	23,392	15,257	Iran 8,535; India 6,225.
Cobalt and cobalt base alloys	78	72	Zambia 41; Belgium-Luxembourg 8; Congo (Brazzaville) 8.
Copper:			
Ore and concentrate	2,205	40	NA.
Scrap	597	1,023	New Zealand 888.
Ingots, blocks, billets	3,127	325	Mainly from Chile.
Semimanufactures	679	371	United Kingdom 324.
Pipe, tubes, powder, wire	2,050	1,321	Japan 713; United Kingdom 440.
Gold:			
Crude bullion, gold content, troy ounces	147,902	140,560	Fiji 104,437; Papua and New Guinea 26,505.
Refined bullion—do	3,890	5,168	Papua and New Guinea 4,201; West Germany 584.

See footnotes at end of table.

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Table 3.—Australia: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1966–67	1967–68	Principal sources, 1967–68
METALS—Continued			
Iron and steel:			
Ore and concentrate, includes pyrite materials	207,331	170,930	Mainly from New Caledonia.
Scrap	17	114	NA.
Ferroalloys:			
Ferrochromium	2,799	4,865	Republic of South Africa 3,489; Japan 924.
Ferromanganese	5,689	10,627	Republic of South Africa 5,426; Italy 4,319.
Ferromolybdenum	196	185	United Kingdom 125; Sweden 21.
Ferrosilicon	9,773	6,933	Republic of South Africa 4,238; Norway 1,753.
Ferronickel	1,248	3,583	Greece 2,414; New Caledonia 1,092.
Other	1,091	2,175	Sweden 777; United Kingdom 590; Republic of South Africa 550.
Ingots, blooms, etc	6,905	14,688	Japan 14,385.
Semimanufactures	190,003	241,963	Japan 137,704; United Kingdom 48,985.
Pipes, tubes, castings and forgings	57,974	99,309	Japan 46,295; United Kingdom 21,351; West Germany 13,643.
Lead and lead alloys	44	513	New Zealand 480.
Magnesium and magnesium base alloys	1,044	613	Norway 340; United States 107; Canada 105.
Manganese ore:			
Battery grade	1,091	1,592	Ghana 1,524.
Metallurgical grade	6,397	6,800	Mainland China 2,555; Republic of South Africa 2,096; Fiji 1,879.
Mercury, 76-pound flasks	1,868	1,491	Italy 740; Spain 421.
Nickel:			
Matte and other crude forms	138	273	Mainly from Canada.
Pigs, ingots, granulated	996	1,628	Canada 1,079; United Kingdom 241.
Bars, rods, anodes, powder	632	414	Canada 158; United Kingdom 148; West Germany 47.
Platinum-group metals, troy ounces	9,374	14,564	United Kingdom 12,803; United States 1,478.
Silicon metal, value, thousands	$473	$486	Italy $95; Norway $76; Sweden $74; Yugoslavia $68.
Silver:			
Crude bullion, silver content troy ounces	96,069	73,948	Fiji 49,655; Papua and New Guinea 12,950; New Zealand 7,646.
Refined bullion, do	10,951	8,930	NA.
Tin and tin base alloys, long tons	746	137	Mainly from Malaysia.
Tungsten and tungsten base alloys	18	12	Canada 4; United Kingdom 4.
Zinc:			
Ore and concentrate	6,310	------	
Zinc and zinc base alloys	74	32	NA.
NONMETALS			
Abrasives:			
Industrial diamond, carats	490,794	541,389	Republic of South Africa 274,193; United States 132,748; United Kingdom 59,688.
Pumice and tripoli	1,066	951	United States 527; Italy 109.
Garnet	117	88	Mainly from United States.
Asbestos:			
Chrysotile	38,845	41,843	Canada 41,043.
Amosite	8,609	10,305	Republic of South Africa 9,824.
Other	2,546	3,107	Canada 2,776.
Barite, ground and unground	1,492	1,644	All from United States.
Boron minerals, crude and concentrate	2,043	1,985	Mainly from United States.
Cement, construction types	50,401	52,777	Japan 29,601; United Kingdom 9,104; Denmark 5,541.
Clays:			
China, kaolin, pottery	24,676	22,635	United Kingdom 13,284; United States 9,085.
Fire and ball	13,145	16,927	United Kingdom 11,338; Republic of South Africa 4,167.
Bentonite	14,649	33,618	United States 33,110.
Other	12,141	14,372	United States 10,878; Republic of South Africa 3,414.
Cryolite, natural and synthetic	173	289	All from Denmark.
Diatomite and other earths	5,163	4,809	United States 4,226.
Fertilizer materials:			
Nitrogenous:			
Sodium nitrate, natural	4,687	5,654	Chile 5,147.
Manufactured nitrogenous fertilizers	108,025	150,917	Japan 106,039.

See footnotes at end of table.

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Table 3.—Australia: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1966–67	1967–68	Principal sources, 1967–68
NONMETALS—Continued			
Fertilizer materials—Continued			
Phosphatic:			
Phosphate rock..thousand tons..	3,324	3,349	Nauru 1,424; Christmas Island 831; United States 532.
Other manufactured phosphatic materials	270	31	NA.
Potassic:			
Potassic salts, natural	8	-------	
Manufactured potassic materials	121,842	132,213	United States 119,559.
Other and mixed fertilizers	42,202	42,944	West Germany 12,341; Netherlands 10,317; Italy 7,996.
Fluorspar	18,272	21,131	Mainland China 12,200; United Kingdom 6,150; Republic of South Africa 2,456.
Gem stones:			
Gem diamond.....carats..	27,334	27,016	Belgium-Luxembourg 9,111; Republic of South Africa 6,625; Israel 6,224.
Pearls and other precious and semi-precious.....value, thousands..	$1,605	$1,589	Japan $487; India $175.
Gypsum, crude and calcined	775	685	United Kingdom 381; United States 162.
Graphite:			
Colloidal	39	24	United Kingdom 14.
Crystalline, flake	294	432	Malagasy Republic 209.
Amorphous	1,177	863	South Korea 375; Ceylon 272.
Iron oxide pigments	7,076	8,232	West Germany 3,117.
Kyanite	1,694	1,163	India 736; United States 346.
Limestone	276,270	312,516	Mainly from Japan.
Lithopone	992	1,098	West Germany 611; United Kingdom 370.
Magnesite, crude, calcined and fused	18,127	26,723	Japan 23,821; United States 2,807.
Mica:			
Block or sheet	19	18	Mainly from India.
Splittings	78	90	All from India.
Ground and scrap	737	965	Republic of South Africa 570; India 189.
Phosphorus	380	620	West Germany 549.
Quartz and quartzite	480	438	Sweden 248.
Salt	13,236	8,934	United Kingdom 8,005.
Sillimanite	447	748	Republic of South Africa 740.
Stone, construction....value, thousands..	$457	$456	Italy $295.
Sulfur, elemental	507,038	586,749	Canada 301,723; United States 141,235; Mexico 135,531.
Talc, steatite and chalk	11,699	9,720	France 6,031; United Kingdom 1,599; mainland China 1,218.
Vermiculite	2,251	3,336	Mainly from Republic of South Africa.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, bitumen and pitch:			
Natural minerals	654	1,085	Trinidad and Tobago 651; United States 411.
Petroleum bitumen	233	208	United Kingdom 179.
Coal tar and coal tar pitch	10,912	5,788	United States 5,682.
Carbon and carbon black	2,906	3,373	United States 2,936; United Kingdom 383.
Coal, all types, including briquets	8,441	8,663	Republic of South Africa 7,298; United States 1,327.
Coke and semicoke	53,385	40,537	Mainly from United States.
Peat	2,797	3,232	West Germany 2,019; Ireland 668; Poland 456.
Petroleum:			
Crude....thousand 42-gallon barrels..	141,598	144,010	Indonesia 34,456; Kuwait 33,706; Saudi Arabia 31,750.
Refinery products:			
Liquefied petroleum gas 42-gallon barrels..	1,461	3,277	United States 2,178.
Gasoline thousand 42-gallon barrels..	3,796	3,239	Southern Yemen 1,468; Singapore 557; Iran 528.
Kerosine and jet fuel.....do....	1,067	824	Singapore 326; Southern Yemen 307.
Distillate fuel oil.....do....	1,081	760	Singapore 523; Saudi Arabia 174.
Residual fuel oil.....do....	462	604	Singapore 600.
Lubricants.....do....	368	404	United States 222; United Kingdom 68.
Petroleum turpentine.....do....	38	39	Iran 24; United States 11.
Other products.....do....	870	1,416	Bahrain 1,231.

NA Not available.
[1] Periods shown are fiscal year, July 1 to June 30.

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COMMODITY REVIEW

METALS

Aluminum.—All sectors of Australia's aluminum industry set new output records in 1969. Mines near Weipa in northern Queensland and in the Darling Ranges of Western Australia accounted for most of the 60-percent annual increase in bauxite production. Recently completed expansion of alumina plant capacities at both Gladstone, Queensland, and Kwinana, Western Australia, resulted in the bulk of the 47-percent-higher alumina output. With the start of operations at the Alcan Australia Ltd. smelter at Kurri Kurri, New South Wales, in July, and added facilities in Alcoa of Australia Pty. Ltd., Point Henry smelter, the year's output of ingot aluminum was 30 percent more than in 1968.

Comalco Industry Pty. Ltd. shipments of bauxite from Weipa amounted to about 4.9 million tons in 1969, of which about half went to Japan and the balance to alumina refineries at Gladstone, Queensland, and Bell Bay, Tasmania. Comalco programs already underway at Weipa include expansion of mining capacity to 10 million tons annually by 1972, and construction of a plant to produce 100,000 tons of calcined bauxite (abrasive) per year beginning in 1970. In April 1969 the company proposed formation of a consortium to finance an alumina refinery at Weipa. The plant would be designed for an initial annual capacity of 600,000 tons, with provision for eventually tripling this figure. And late in the year Comalco announced plans to increase aluminum ingot capacity at its Bell Bay smelter from 75,000 to 96,000 tons per year by early 1971.

A change in the corporate structure of the bauxite-alumina project on the Gove Peninsula, Northern Territory, was reported early in 1969. Swiss Aluminium Australia Pty. Ltd. acquired 70-percent interest and will manage the venture. Gove Alumina Ltd. (comprising Colonial Sugar Refining Co. Ltd. and other Australian interests) holds the remaining 30 percent. Estimates of investment required for the project have been raised from $112 million to $335 million. Exports of bauxite and operation of the alumina plant are scheduled to begin in 1971.

The mines of Western Aluminium N.L (subsidiary of Alcoa of Australia Pty, Ltd.) near Jarrahdale, in the Darling Ranges, Western Australia, supplied about 3 million tons of bauxite to the company's alumina refinery at Kwinana in 1969. The mining rate will be accelerated to meet alumina capacity at Kwinana that by late 1970 is expected to be about 1.25 million tons annually. Under agreements recently arranged with the Government of Western Australia, Western Aluminium N.L. is committed to establish a new alumina refinery of 420,000 tons annual capacity in the Pinjarra District of Western Australia and to provide alumina loading facilities at Bunbury. Completion of these projects is scheduled for 1972.

Early in 1970, Amax Bauxite Corporation Ltd., submitted proposals for development of bauxite deposits and construction of an alumina refinery in the Kimberly-Admiralty Gulf region of northern Western Australia. As proposed, the venture will require investment of $225 million, to be financed by an international (West German, Dutch, Japanese, American, and Australian) consortium of private companies and banks. The alumina plant, which will have an annual capacity of 1.2 million tons can be completed by 1973.

In March 1969 Queensland Alumina Ltd. announced that its annual production capacity would be increased from 900,000 to 1.3 million tons. Following this expansion, equity holdings in the enterprise will be Kaiser Aluminum & Chemical Corp. (United States)—43 percent, Alcan Aluminium Ltd. (Canada)—22 percent, Pechiney Group (France)—20 percent, and Conzinc Riotinto of Australia Ltd. (CRA)—15 percent.

The new Alcan Australia Ltd. smelter at Kurri Kurri, New South Wales, began production of aluminum metal in July and by yearend was producing at an annual rate of 30,000 tons. It is expected to be up to full capacity, 50,000 tons, by mid-1970.

On the basis of announced expansion plans and new developments, the Bureau of Mineral Resources[4] has forecast 1972 annual production capacity of Australia's aluminum industry at about 18 million tons of bauxite, 3 million tons of alumina, and 216,000 tons of aluminum. For the

[4] Bureau of Mineral Resources, Geology and Geophysics. Australian Mineral Industry, 1968 Review. Canberra, 1969, p. 41.

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1972–73 fiscal year, exports of these products are expected to return about $200 million.

Copper.—Both mine output and smelter production of blister and refined copper were at record levels in 1969. According to preliminary estimates, mines accounted for an annual increase of 23 percent, and production of primary blister copper, most of which has been refined locally, was 19 percent more than in 1968. These increases are credited largely to expansion programs recently completed at Mount Isa Mines Ltd. in Queensland, and greater production from Cobar Mines Pty. Ltd. in New South Wales.

The principal copper producers and quantities of their output in recent years are summarized in the accompanying table.

During the company year ending June 30, 1969, Mount Isa Mines Ltd., in northwestern Queensland, treated 3.08 million tons of copper ores containing 2.4 percent copper. Production of blister copper during the period totaled 74,029 metric tons. The year's mine development and diamond drilling activities revealed 30 million tons of additional ore, resulting in a mid-1969 estimate of copper ore reserves at 78 million tons, averaging 3.1 percent copper.

Cobar Mines Pty. Ltd., largest producer in New South Wales, reported treating 625,000 tons of copper and copper-zinc ores during the year ending June 30, 1969. Copper concentrate production amounted to 50,070 tons grading 23.2 percent copper.

The Mount Lyell Mining and Railway Co. Ltd., in western Tasmania, closed its smelter in December 1969 after negotiating a contract to ship concentrates containing about 10,000 tons of copper annually to Japan. Shipments for the domestic market will be reduced to about 5,000 tons per year, in concentrates, to the Electrolytic Refining and Smelting Co. of Australia Pty. Ltd. at Port Kembla, New South Wales.

Exploration and development of copper prospects have continued at a relatively high level throughout Australia. Texas Gulf Sulphur Co., of the United States, recently reported discovery of an ore body containing 15 million tons of 1 percent copper ore at Mons Cupri in the Pilbara district of Western Australia. And in October a group of Australian companies, headed by Broken Hill South Ltd., announced plans to establish an open-cut mine at Kanmantoo, South Australia. The ore body, which has been estimated to contain 15 million tons of 1 percent ore, will be mined at an annual rate of 750,000 tons.

Early in 1970 Bougainville Copper Pty. Ltd. (a subsidiary of CRA) announced an upward revision of its estimate of ore reserves on Bougainville Island, in the Territory of New Guinea, to 900 million tons containing 0.48 percent copper. Shipment of concentrates is expected to start in 1972. An annual production rate of 155,000 tons of contained copper is planned. Sales contracts have been signed or are pending with Japanese, West German, and Spanish interests.

Table 4.—Australia: Major copper industry facilities

Facility	Production (metric tons of copper [1])		
	1966	1967	1968
Mines:			
Mount Isa Mines Ltd	65,159	44,475	60,729
Mount Morgan Ltd	7,932	6,874	8,070
Broken Hill field	3,084	3,583	3,346
Cobar Mines Pty. Ltd	6,048	7,781	8,953
Mount Lyell Mining and Railway Co. Ltd	15,656	16,133	16,371
Electrolytic Zinc Co. of Australasia Ltd	1,622	1,615	1,743
Ravensthorpe Copper Mines, N.L.	591	721	749
Tennant Creek field	6,928	8,031	7,749
Rum Jungle field	2,906	716	189
Smelters:			
Mount Isa Mines Ltd	64,719	44,406	62,943
Mount Morgan Ltd	6,981	6,759	7,301
Electrolytic Refining and Smelting Co. of Australia Pty. Ltd. [2]	6,070	5,497	10,213
Mount Lyell Mining and Railway Co. Ltd	14,169	15,301	13,481
Refineries:			
Mount Isa Mines Ltd	69,285	45,979	64,519
Electrolytic Refining and Smelting Co. of Australia Pty. Ltd	22,118	21,174	21,102

[1] Metal content of ore for mines; primary blister copper for smelters; and primary electrolytic for refineries.
[2] Treats concentrates from Cobar Mines Pty. Ltd.

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Gold.—The downtrend in total gold production continued throughout 1969 with output data 9 percent below that of 1968, and the lowest since 1945 when gold mining generally was restricted by wartime controls. The past year's production of 453,854 ounces from Western Australia was 62,350 ounces less than in 1968. Queensland's total was down 11,443 ounces to 71,411. Despite the production of around 100,000 ounces from the Orlando Mines N.L., Juno mine (whose average recovery of 3.81 ounces per ton in 1968 marks it as one of the world's richest mines) production from Northern Territory dropped about 2,000 ounces in 1969 to 129,496 ounces.

Commonwealth Government payments under the Gold Mining Assistance Act totaled $1.21 million in 1969, compared with $3.16 million in 1968. To those producers that have taken advantage of sales on premium markets through the Australian Gold Producers' Association, the price in 1969 averaged A$36.81 (A$35.62 in 1968).

In 1968, the most recent year for which details are available, gold mines accounted for 79 percent of Australia's total gold production. Approximately 4 percent was recovered in bismuth concentrates at the Juno mine, and 17 percent was recovered as a byproduct of base metal mining operations. The principal gold producers and quantities recovered during 1968 were as follows:

Company	Gold produced (troy ounces)
Central Norseman Gold Corp. N.L.	84,016
Gold Mines of Kalgoorlie (Aust.) Ltd.	153,378
Great Boulder Gold Mines Ltd.	39,732
Hill 50 Gold Mine N.L.	32,456
Lakeview and Star Ltd.	130,410
North Kalgurli (1912) Ltd.	63,578
Orlando Mines N.L.[1]	112,890

[1] Includes Juno mine—100,418 ounces.

Australia's precious metal refineries include the Royal Mint, at Perth, which handles all Western Australia and some overseas gold; Englehard Industries Pty. Ltd. in Melbourne, and Matthey Garrett Ltd., in Sydney. The smelters at Port Pirie and Port Kembla operate refineries for gold recovered in their base metal plants. Total production of refined gold in 1969 was 720,888 ounces, of which 586,396 came from domestic mines, 16,804 from domestic scrap, 116,957 ounces from overseas mines, and 731 ounces from imported scrap. The great bulk of foreign gold came from underground mines in Fiji and from placer operations in New Guinea.

According to trade records, Australia's gold exports in 1969 totaled 691,093 ounces, which included 94,004 ounces in ores, concentrates, blister copper, etc., mostly to Japan and the United States; and 597,089 ounces in refined forms, of which about 593,000 ounces went to the premium markets of Hong Kong and Singapore.

Iron and Steel.—The rapid rise to international prominence as a supplier of iron ore and expansion of the relatively small domestic iron and steelmaking facilities continued through 1969. At the 1969 rate of nearly 40 million tons, production of iron ore, including concentrates and pellets, was about 48 percent greater than in 1968. And according to early estimates Australia ranks fifth, after the U.S.S.R., the United States, West Germany, and Canada, among the world's leading iron ore producers.

The domestic iron and steel industry, dominated by Broken Hill Pty. Co. Ltd. (BHP) and its affiliates, recorded annual gains of 10 and 9 percent, respectively, for pig iron and ingot steel output. Quantity details of these products, as well as iron ore, are given in table 1.

Iron Ore.—Mines in Western Australia, including those that provided the bulk of export shipments, accounted for about 75 percent of the iron ore produced in 1969. South Australia, which was the principal supplier to the domestic iron and steel industry, contributed 21 percent. Tasmania and the Northern Territory, both of which contributed largely to exports, added 5 and 2 percent, respectively.

Principal producers and quantities of products shipped during the year were as follows, in thousands of metric tons:

Goldsworthy Mining Ltd., Western Australia (lump)	5,100
Hamersley Iron Pty. Ltd., Western Australia (lump, pellets)	13,298
Western Mining Corp. Ltd., (WMC), Western Australia (lump)	556
Broken Hill Pty. Co. Ltd., Western Australia (lump)	8,688
Broken Hill Pty. Co. Ltd., South Australia (lump, pellets)	6,818
Savage River Mines, Tasmania (pellets)	1,907
Frances Creek Iron Mining Corp. Ltd., Northern Territory (lump)	780

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Exports of iron ore from Australia in 1969 totaled 26.9 million tons (including 5.1 million tons of pellets), compared with 16.4 million in 1968. Although a number of contracts have been negotiated with European and United States iron and steelmakers for small quantities, the major market for Australian iron ore is Japan. As of June 30, 1969, contracts held by nine Australian companies called for deliveries totaling 535 million tons of ores and pellets to Japan throughout the 1970 and 1980 decades. The latest addition to the list is a contract signed on April 28 by Cliffs Western Australian Mining Co. Pty. Ltd. with seven Japanese steel mills for 125 million tons of pellets and fines from Robe River, Western Australia, beginning in 1971.

In December Hamersley Iron Pty. Ltd. announced the signing of a long-term contract with Japanese steel interests for an additional 114 million tons of ore, beginning in 1972. The company will supply this ore from a new mine to be developed at Paraburdoo. Construction of a 65-mile rail link from the existing Mount Tom Price-Dampier railroad will be required.

Pig Iron and Steel.—With the exception of a small quantity (59,000 tons in 1968) of pig iron produced by the State-owned Wundowie Charcoal Iron and Steel Works in Western Australia, all of Australia's primary iron and steel is produced by BHP and its wholly owned subsidiaries, Australian Iron and Steel Pty. Ltd., and Commonwealth Steel Co. Ltd. The consolidated annual reports for periods ending May 31, 1968, and May 31, 1969, summarize output of various products as follows:

Commodity	Thousand metric tons	
	1968	1969
Pig iron	5,249	5,768
Steel ingots and billets	6,396	6,702
Blooms and slabs	5,565	5,835
Sheets, bars, billets, etc.	2,766	2,958
Plate and strip	2,256	2,379
Merchant	1,401	1,518
Rod	494	515
Narrow cold-rolled strip	82	78
Tinplate	260	260

A total capital expenditure during the 1969 fiscal year amounted to $170 million; however, as in previous years, a large part of this went to petroleum activities, development of raw material sources, and improving fabricating facilities. At the Newcastle steelworks, construction continued on new coke ovens, additional dust precipitators, and oxygen plant extensions. A new $7 million fume control facility was commissioned during the year at Port Kembla. Plans have been announced for a $155 million expansion at the Port Kembla works that will raise annual pig iron production from 2.5 to over 4 million tons and raise ingot steelmaking capacity from 3.5 to about 6 million tons by 1971. Stage one of the steel plant project at Kwinana, Western Australia, was completed at a cost of $45 million, and officially opened during the period.

An agreement for establishing a fully integrated iron and steel complex at Westernport, Victoria, has recently been signed by BHP, Guest, Keen and Nettlefords (of United Kingdom), and the Victoria Government. The plan provides for a plant capable of making 2 million tons of ingot steel in the first stage and 4 million tons in the next stage. Operation of the rolling mill section, which will be built first and initially supplied from Port Kembla, is scheduled to start in 1972.

Lead and Zinc.—The bulk of Australia's lead and zinc is produced in 30-odd mines that recover both metals from complex sulfide ores. In 1969, mine output of both lead and zinc set new records, that are 15 and 19 percent higher, respectively, than in 1968. The four smelters and refineries that treat lead and zinc mine products also operated at record levels, achieving annual gains of 16 and 18 percent. These industry-wide increases are attributed to resumption of normal operations, following strike closures that seriously curtailed production in 1967 and 1968, and to completion of expansion programs at Mount Isa.

Although mines in two other States and Northern Territory contribute small quantities, more than 99 percent of each metal is from the Broken Hill region of New South Wales, the Mount Isa region of Queensland, and the Read-Rosebery area in Tasmania. Leading company producers and quantities recovered in concentrates and other mine products in recent years were as follows, in metric tons:

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Mine	1966		1967		1968	
	Lead	Zinc	Lead	Zinc	Lead	Zinc
North Broken Hill Ltd	65,117	52,151	68,808	55,526	62,768	50,703
Broken Hill South Ltd	28,165	29,569	27,401	28,330	23,425	26,823
The Zinc Corp. Ltd	103,030	84,062	98,685	82,069	86,626	70,256
New Broken Hill Consolidated Ltd	90,428	113,423	88,565	131,973	76,369	127,754
Mount Isa Mines Ltd	66,577	44,288	78,240	51,848	118,552	85,411
Electrolytic Zinc Co. of Australasia Ltd. (Read-Rosebery)	15,828	50,651	15,377	49,634	15,150	49,521

In 1968 (1967 figures in parentheses) the Sulphide Corp. Pty. Ltd. smelter at Cockle Creek, New South Wales, which treats concentrates from Cobar and Broken Hill, produced 19,185 (20,736) tons of lead bullion and 49,361 (52,985) tons of zinc metal. The Mount Isa smelter, in Queensland, recovered 103,850 (84,688) tons of lead bullion. The Broken Hill Associated Smelters Pty. Ltd., at Port Pirie, South Australia, produced 186,464 (193,926) tons of refined lead, most of which was from Broken Hill mine products. The Electrolytic Zinc Co. of Australasia Ltd., at Risdon, Tasmania, recovered 135,586 (144,607) tons of zinc, including high-grade and special high-grade metal, from concentrates produced at Broken Hill and the company's own Read-Rosebery mines.

Geological studies and metallurgical testing by Mount Isa Mines Ltd. have continued on the McArthur River, Northern Territory, lead-zinc ore body; but the lead-zinc highlight of the year was the company's announced decision to proceed with development of the Northern Leases. They lie about 12 miles north of Mount Isa. Following mine development, construction of mill, smelter, and transport facilities, operation is expected to begin in 1976. Anticipated production of lead, silver, and zinc from the new site will be about the same magnitude as the Mount Isa operation.

Manganese.—Continuing the rapid growth that started in 1965 with the opening of the BHP mines on Groote Eylandt, Australian production of metallurgical-grade manganese ore in 1969 exceeded 900,000 tons, an annual increase of nearly 25 percent. After supplying the bulk of the domestic requirement (190,000 tons in 1968), Australia's manganese ore exports in 1969 totaled about 660,000 tons; approximately two-thirds of which went to Japan; the remainder went to United States and West European Markets.

During the year ending May 31, 1969, Groote Eylandt Mining Co. Pty. Ltd. (subsidiary of BHP) shipped a total of 588,800 tons of manganese ore. Exports during the same period amounted to 420,000 tons. The parent company recently announced plans for a $25 million expansion program on Groote Eylandt that will include a concentrating plant and additional shipping facilities to raise production to 800,000 tons per year by mid-1971, and to 1.1 million tons by 1974.

In Western Australia, the manganese properties near Woodie Woodie and Ripon Hills in the Pilbara region, previously owned by Mt. Sydney Manganese Pty. Ltd., were acquired late in 1968 by Longreach Manganese Pty. Ltd. Anticipating additional sales contracts with Japanese steel companies, the new owner plans to double the present output level of 60,000 to 80,000 tons per year.

Westralian Ores Pty. Ltd. operates mines in the vicinity of Mount Cook, Pilbara Region, and near Peak Hill in the west-central part of the State. From the two mines the company produces and exports about half of the manganese ore mined in Western Australia.

Apparent domestic consumption of metallurgical-grade ore was 190,000 tons in 1968, compared with 244,000 tons in 1967.

Nickel.—Throughout 1969 the Western Mining Corp. Ltd. (WMC) operation at Kambalda, Western Australia, accounted for the entire Australian output of nickel. According to that company's statements for the year ending January 6, 1970, the mill treated 364,000 tons of ore and recovered 92,435 tons of concentrate containing 11,069 tons of nickel. Ore reserves, as of June 30, 1969, were estimated at 15.8 million tons averaging 3.7 percent nickel. The program of mine and mill expansion aimed at annual production of 30,000 tons of nickel in concentrates was nearing completion at yearend. Shipment of concentrates from Kambalda to the New WMC nickel refinery at Kwinana are to start in

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January. Commissioning of the refinery, which uses the ammonia leach (chemical reduction) process developed by Sherritt Gordon Mines Ltd. of Canada, is scheduled to take place in May 1970. In addition to supplying capacity requirements (16,000 to 18,000 tons contained nickel per year) to the Kwinana plant, WMC is committed to export about 4,000 tons of nickel per year in concentrates to Japan.

Spurred by the outstanding success of WMC, exploration and development activities in the goldfields region (from Norseman to Wiluna) of Western Australia, and in more remote parts of Australia have continued at an intense level.

In January 1969 production shipments of ore were started at the Nepean mine, jointly owned by Metals Exploration Pty. Ltd. and Freeport of Australia, Inc. The mine is situated about 30 miles west of Kambalda. Truck shipments totaling about 120 tons per day were to the WMC concentrator at Kambalda.

The Great Boulder Gold Mines Ltd.—North Kalgulie (1912) Ltd. partnership at yearend was also about ready to start production of nickel concentrates from the Scotia mine, situated on the branch railroad, about 40 miles north of Kalgoorlie. The partnership recently announced a new prospect at Carr Boyd Rocks, 30 miles east of Scotia. The new find reportedly contains over 1 million tons averaging 1.74 percent nickel and 0.53 percent copper. Production from this deposit is planned to start in 1971. On the basis of production from both the Scotia and Carr Boyd Rocks, the company is considering construction of a nickel-matte smelter.

The Broken Hill Pty. Co. Ltd.-International Nickel Southern Exploration Ltd. partnership recently announced a new nickel discovery near Widgiemooltha, 20 miles south of Kambalda. At Wannaway, 8 miles south of Widgiemooltha, a deposit estimated to contain 3 million tons averaging 1.2 percent nickel and 0.1 percent copper has been outlined by diamond drilling. The partners in this project include The Anaconda Company, CRA, and New Broken Hill Consolidated Ltd.

Poseidon N.L. announced in December 1969 that drilling its Windarra prospect near Laverton, 180 miles north-northeast of Kalgoorlie, had indicated over 4 million tons of ore averaging 2.4 percent nickel and 0.3 percent copper.

Silver.—Reflecting the increased mine output of lead and other metals with which it is coproduced, Australian silver production in 1969 set a new record. The expanded scale of operation at Mount Isa Mines Ltd., through 1968 and the first 9 months of 1969, resulted in Queensland replacing New South Wales as Australia's leading silver State. According to data for the 1968 calendar year, Queensland accounted for 44.9 percent, New South Wales accounted for 44.5 percent, Tasmania accounted for 8.2 percent, and three other States accounted for a total of 2.4 percent of the national mine output of silver. The great bulk—89 percent in 1968—was recovered in lead bullion and concentrates. Zinc and copper concentrates contained 5 and 4 percent, respectively, and other mine products (including crude gold bullion) 2 percent of the total. Principal company sources of silver produced during 1967 and 1968 were as follows:

Company	Thousand troy ounces	
	1967	1968
North Broken Hill Ltd	3,897	3,520
Broken Hill South Ltd	1,774	1,515
Zinc Corp. Ltd	2,443	2,323
New Broken Hill Consolidated Ltd	2,190	1,814
Mount Isa Mines Ltd	6,787	9,566
Electrolytic Zinc Co. of Australasia Ltd	1,716	1,662

Australian refineries reported production of 9,749,000 ounces of refined silver in 1969, compared with 9,613,000 ounces the previous year. In 1968 Broken Hill Associated Smelters Pty. Ltd., at Port Pirie, recovered 7.9 million ounces of refined silver, mostly from lead concentrates produced in Broken Hill mines. Electrolytic Refining and Smelting Co. of Australia Pty. Ltd., at Port Kembla, refined 1.4 million ounces from copper concentrates and slimes. The Royal Australian Mint, Perth, Western Australia, in 1968 recovered about 250,000 ounces as refined silver from gold bullion produced by mines in Western Australia.

Exports of silver in lead bullion, various concentrate and other products, in 1968 amounted to about 11,272,000 ounces. Domestic sales totaled 2,973,000 ounces.

Tin.—The effect of expansion programs undertaken by Australian producers has been reflected in substantially increased mine output of tin during the past 2 years. Despite adverse weather conditions

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that temporarily affected alluvial operations in some localities, total production in 1969 increased 20 percent, thereby achieving a new annual peak. The recent increase has been credited to the hard-rock mines of Cleveleland Tin N.L. and Renison Ltd. in Tasmania, and the two new alluvial mines: Gibsonvale Alluvials N.L. in New South Wales, and Greenbushes Tin N. L. in Western Australia.

Principal producers of tin concentrates and quantities of contained tin produced in 1967 and 1968 were as follows:

Company	Long tons	
	1967	1968
Aberfoyle Tin Co. N.L.	422	389
Ardlethan Tin N.L.	655	647
Austral Malay Tin Ltd	216	107
Australian Placer N.L.	136	58
Cleveland Tin N.L.	NA	683
Cooglegong Tin Pty. Ltd	219	77
Gibsonvale Alluvials N.L.	19	192
Greenbushes Tin N.L.	• 40	200
J. A. Johnston & Sons Pty. Ltd.	185	86
Pilbara Tin Pty. Ltd	303	233
Ravenshoe Tin Dredging Ltd.	568	496
Renison Ltd	720	1,782
Storeys Creek Tin Mining Co. N.L.	161	100
Tableland Tin Dredging, N.L.	448	313
Tullabong Tin Ltd	323	272

• Estimate. NA Not available.

All primary refined tin produced in Australia is by Associated Tin Smelters Pty. Ltd.[5] near Sydney, New South Wales. Production in 1969 amounted to 4,156 long tons (3,692 long tons in 1968). In addition, 400 to 500 tons of secondary tin is recovered annually from tinplate scrap by M.&T. Chemicals (Australia) Pty. Ltd., Unanderra, New South Wales, and Albert G. Sims, Melbourne, Victoria.

Domestic consumption of primary tin, mainly for the manufacture of tinplate, amounted to 3,846 long tons in 1968. Exports of tin in that year included 234 tons of refined metal and 3,004 tons in concentrates. The bulk of exported tin concentrates went to the Netherlands.

Titanium Concentrates.—All sectors of the beach sands mining industry recorded substantial increases in 1969.

Production of ilmenite concentrates from Western Australia beach sand operations in the Bunbury-Capel region totaled about 690,900 tons. This indicates the near completion of expansion programs aimed at 760,000 tons per year by 1970. The Western Titanium N.L. plant at Capel, largest west coast producer, attained a 274,000-ton annual capacity rate in September 1969 and promptly announced plans for further increase to 305,000 tons. Other west coast producers that at yearend had expansion programs underway or recently completed include Western Mineral Sands Pty. Ltd., Westralian Sands Ltd., Cable (1956) Ltd., and Laporte Titanium (Aust.) Ltd. In 1969, recovery of ilmenite concentrates from New South Wales and Queensland beach sands, which are mined primarily for rutile and zircon, amounted to 14,000 tons. Late in the year the new plants of Murphyores, Inc. Pty. Ltd., near Gladstone, Queensland, started operation. Achievement of the planned 200,000-ton-per-year rate will significantly increase east coast production of ilmenite concentrates.

New South Wales and Queensland beach sand operations accounted for 98 percent of the rutile concentrate and 84 of the zircon concentrates produced in Australia during 1969. The east coast industry includes about a dozen companies, several of which are active in two or more sites. Major producers in Queensland include Associated Minerals Consolidated Ltd. at Southport, Titanium & Zirconium Industries Pty. Ltd. and Consolidated Rutile Ltd. on the North Stradbroke Island, and Titanium Mines Pty. Ltd. at Inskip Point. In New South Wales, Associated Minerals Consolidated Ltd. also has operations at Big Swan Bay, Port Stephens, and Lake Munmorah. Rutile & Zircon Mines (Newcastle) Ltd. operates at several localities north of Newcastle. Mineral Deposits Pty. Ltd. works are at Port Stephens and Crescent Head, and New South Wales Rutile Mining Co. Pty. Ltd. operates on the north coast.

Domestic consumption of titanium concentrates in 1968 amounted to about 2,300 tons of rutile, mainly for manufacture of arc-welding rods; and 75,000 tons of ilmenite, most of which went to domestic pigment producers.

Consumption of zirconium concentrates has been estimated, on the basis of domestic sales, at about 4,000 to 4,500 tons per year. The bulk of this consumed by foundries and manufacturers of ceramic products.

[5] The smelter, commissioned in 1967, is a joint venture of O.T. Lempriere and Co. Ltd., Consolidated Tin Smelters (Australia) Pty. Ltd. and Australian Iron and Steel Pty. Ltd.

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NONMETALS

Phosphate Rock.—While the several deposits found in recent years in northwestern Queensland are regarded as important future sources, Australian phosphate rock requirements are met almost entirely by imports. Domestic production is limited to about 5,000 tons per year from the Angaston district, South Australia. Imports of phosphate rock in 1969 totaled 2.8 million tons (3.5 million in 1968). The British Phosphate Rock Commissioners operations on Nauru and Ocean Islands in the Pacific and Christmas Island in the Indian Ocean accounted for 75 percent of the phosphate rock imported in the 1968–69 fiscal year. Smaller quantities were also supplied by the United States and other countries.

Exploration activities by Government and industrial groups have intensified throughout the past year in northwestern Queensland and in several marine areas. Investigations, including diamond drilling, shaft sampling, beneficiation research and feasibility studies, have been continued on the several prospects controlled by Broken Hill South Ltd., International Minerals & Chemical Corp. (IMC), and Continental Oil Co. of Australia Ltd.

Commonwealth Government payments to domestic manufacturers of superphosphate fertilizers, under the Phosphate Fertilizer Bounty Act (1963–69), amounted to $39.7 million in 1969, compared with $27.9 million in 1968. Production during the year (double and triple superphosphate and ammonium phosphate expressed in terms of superphosphate of 22 percent P_2O_5 equivalent) totaled 3.84 million tons.

Salt.—Although complete statistical data are not available, Australia's salt industry undoubtedly produced over 1 million tons in 1969. The increase is apparent in officially reported exports of about 300,000 tons in the 1968–69 fiscal year, compared with 169,000 tons for the previous year.

In 1968, producers in South Australia contributed two-thirds of Australia's salt output. Imperial Chemical Industries of Australia and New Zealand Ltd. (I.C.I.A.N.Z.) salt fields at Dry Creek, and BHP near Whyalla produced 427,000 and 61,000 tons, respectively. Other companies produced from works at Price, Lake MacDonnell, Stenhouse Bay, and Lake Fowler. The bulk of Queensland's 1968 production was from Central Queensland Salt Industries Ltd. (56,450 tons) near Rockhampton. Smaller quantities were produced by I.C.I.A.N.Z. at Bajool, and Queensland Salt Pty. Ltd. at Guthalunga. The principal salt producer in Victoria was Cheetham Salt Ltd., whose evaporating pans are on Port Phillip Bay and Corico Bay.

New development projects in Western Australia are expected to raise Australian salt production to 7 to 8 million tons and exports to 4 million tons annually by 1975. The Leslie Salt Co. solar plant at Port Hedland initiated shipments in March and expected to produce 350,000 to 400,000 tons during 1969. Texada Mines Pty. Ltd. also started shipments from Lake McLeod in April; and Norseman Gold Mines Ltd.-Sumitomo Shoji Kaisha Ltd. project at Lake Lefroy planned to start shipments late in 1969 at a rate of about 150,000 tons per year. Projects at Dampier (Dampier Salt Ltd.) and Exmouth Gulf (Exmouth Salt Pty. Ltd.) are expected to commence production in 1971. Following the lead of Shark Bay Salt Pty. Ltd. and Australian Gypsum Industries Ltd., which started shipments in 1967 and 1968, the bulk of new production from Western Australia is destined for export, under long-term sales contracts, to Japan.

Apparent domestic consumption of salt by manufacturers of industrial chemicals and by refineries was estimated at 640,000 tons in 1967 and 730,000 tons in 1968.

Sulfur.—Sulfur is one of the few mineral raw materials in short supply in Australia. There are no known commercial deposits of native sulfur, and natural gas recently found in several widely scattered localities is of very low sulfur content. Australian requirements are met by recovery of sulfur from indigenous pyrite and base metal sulfide ores. A small quantity is also recovered by three oil refineries that process imported and domestic crude petroleum. But imports of elemental sulfur from Canada, United States, Mexico, and other countries are the principal sources of supply. Imports amounted to 390,051 metric tons in 1969; 557,400 tons in 1968.

Pyrite has been mined, primarily for its sulfur content, at Nairne, South Australia; and the pyrite content of gold and other metallic ores is recovered as a concentrate product at Kalgoorlie and Norseman in Western Australia, at Mount Lyell, Tasmania, and Mount Morgan, Queensland.

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In 1969 domestic mines produced about 58,000 tons of sulfur (71,850 tons in 1968) in pyrite concentrates. Base metal smelters at Port Pirie, South Australia; Cockle Creek, New South Wales; and Risdon, Tasmania, recover sulfur for conversion to sulfuric acid, from stack gases. These plants made 348,000 tons of sulfuric acid in 1968.

The previously announced plans of Central Queensland Acid Pty. to provide a sulfuric acid plant at Gladstone, Queensland, have been temporarily shelved. However, construction continued through 1969 on the North-West Acid Pty. Ltd. 420,000-ton-per-year sulfuric acid plant at Burnie, Tasmania.

Australian plants produced 186,650 tons of sulfuric acid in 1969, compared with 189,000 tons the previous year. According to 1968 analyses, 68 percent of the total was made from imported elemental sulfur, 12 percent from pyrite concentrates, and 20 percent from base metal ores and other materials.

Domestic consumption of sulfuric acid in 1968 totaled 1,876,248 tons, of which 78 percent went to manufacture superphosphate fertilizers, 3 percent to ammonium sulfate, 17 percent to various other chemicals, and 2 percent to metallurgical uses.

Government subsidy payments to industry under the Sulfuric Acid Bounty Act amounted to $1.05 million in 1969, compared with $1.43 million in 1968.

MINERAL FUELS

Black Coal.—The growth trend for both production and exports was maintained by Australia's thriving coal industry through 1969. The year's output of over 46 million tons represented an annual gain of 13 percent. Exports, dominated by shipments to Japan in fulfillment of long-term contracts, were up 31 percent to a total of 16 million tons. According to data compiled by the Joint Coal Board,[6] 1968–69 fiscal year, New South Wales production from 88 underground and nine opencut mines amounted to 32.2 million tons, of which 10.3 million tons were exported. Queensland produced 7.5 million tons, mostly from opencut mines, and exported 4.1 million tons. Mines in South Australia, Western Australia, Tasmania, and Victoria produced a total of 3.4 million tons, virtually all of which was consumed locally. The Joint Coal Board report summarizes productivity by type of mining in the leading producer States as follows:

Table 5.—Black coal production per man-shift

(Metric tons, on the basis of all employees)

State	Underground mines			Opencut mines		
	1966	1967	1968	1966	1967	1968
New South Wales	8.8	9.1	9.6	21.4	19.2	28.1
Queensland	6.0	6.2	7.5	18.3	15.8	19.6
South Australia	----	----	----	28.8	30.8	32.6
Western Australia	4.4	4.6	4.9	12.0	13.0	14.0
National total	8.2	8.5	9.1	20.7	19.5	22.9

Prices and terms of many of the existing contracts with Japanese steel, chemical, and utility companies were renegotiated, and several new contracts calling for export of coal from recently developed projects were arranged during 1969. A notable increase in interest in Australia's coal export potential has been shown by European consumers. But the recent rapid growth and current development of Australia's black coal industry are inspired by and geared to supplying the Japanese market. On the basis of contracts in force on June 30, 1969, exports are expected to total 19.1 million tons in 1971 (10.9 million from New South Wales and 8.2 million from Queensland) and 25.5 million tons in 1973 (11.3 million from New South Wales and 14.2 million from Queensland). Australian principals in long-term coal contracts with Japan include the following:

[6] Joint Coal Board. Twenty-Second Annual Report 1968–69. Sydney, Australia, 1969, pp. 268.

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New South Wales:
Bellanbi Coal Co. Ltd.
Kembla Coal and Coke Pty. Ltd.
Clutha Development Pty. Ltd.
Coal & Allied Industries Ltd.
R. W. Miller & Co. Pty. Ltd.
Gollin & Co. Ltd.
Queensland:
Theiss Peabody-Mitsui Pty. Coal Ltd.
Utah Development Co.
Central Queensland Coal Associates Pty. Ltd.
Theiss Holdings Ltd.

With rail transportation and port facilities presently operating at close to maximum capacity in both New South Wales and Queensland, additional transportation and shipping capacity is a major concern to shippers, prospective shippers, and the respective State Governments.

Domestic consumption of black coal in recent years was distributed as follows:

Industry	Thousand metric tons		
	1966–67	1967–68	1968–69
Iron and steel	6,782	7,245	7,612
Electricity	10,979	11,546	12,095
Railways	777	572	480
Town gas	1,148	1,096	925
Cement	865	811	864
Metallurgical coke	440	477	486
Ships bunkers	62	14	5
Other	2,093	2,282	2,294
Total	23,146	24,043	24,711

Brown Coal.—The entire Australian output of brown coal, which has averaged about 23.4 million tons annually since 1966, is produced in southern Victoria. Although several relatively small mines are operated by private companies, approximately 98 percent of the production is from State Electricity Commission (SEC) opencut mines near Morwell and Yallourn in the Latrobe Valley. The SEC mines, power-generating plants, and briquet works are interconnected by a system of conveyors. During the fiscal year ending June 30, 1968, the Yallourn, Morwell, and Morwell North opencuts produced 22.9 million tons of brown coal. The Yallourn opencut supplied 8.78 million tons to the powerplant and briquet works at Yallourn and 3.40 million tons to the Morwell briquet works. The Morwell opencut supplied 2.58 million tons to the Morwell powerplant, 1.34 million to the Yallourn plant, and 6.36 million tons to the new Hazelwood power station.

Since brown coal cannot be economically transported, virtually all output is consumed locally. The use pattern in the past fiscal year approximated 75 percent directly to generation of electric power, 21 percent to manufacture of briquets (a part of which was used in power generation), and about 4 percent to use as factory fuel.

Manufacture of brown coal briquets by the Yallourn and Morwell briquet works in 1969 totaled 1,487,000 tons (1,577,000 tons in 1968).

Petroleum and Natural Gas.—The year 1969 was marked by several events of historic significance to the Australian oil and gas industry. With the completion of transmission pipelines, deliveries of natural gas began in 1969 from Bass Strait, Victoria, to Melbourne; from the Roma field, Queensland to Brisbane; and from Gidgealpa-Moomba, South Australia, to Adelaide. Crude oil from the Barracouta field, in Bass Strait, started flowing via pipeline to refineries in Victoria late in the year.

Barrow Island, off Western Australia, accounted for 85 percent (13.40 million barrels) of Australia's crude oil production in 1969. Approximately 12 percent (1.85 million barrels) was produced from the Moonie-Alton-Bennett fields in Queensland, and initial production from Bass Strait, Victoria, accounted for 3.48 percent (0.55 million barrels).

Exploration activities continued at an intense level throughout 1969. There were indications of increased geological and geophysical activities in the vicinity of established inland fields. However, the greater number of surveys and larger expenditure were offshore. Footage drilled in 1969 was the highest for any year—1,369,183 feet (1,110,652 feet in 1968). Of the total, offshore drilling accounted for 377,681 feet.

Exclusive of wells drilling or suspended on December 31, footage drilled during 1969 totaled 1,291,073 feet in 263 completed holes. This number included 108 classed as oil wells, 26 gas wells, 102 were

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dry, and 27 were service holes. The average depth per well in 1969 was 4,909 feet. Regions of principal drilling activity were Western Australia—647,532 feet in 156 holes, Queensland—274,336 feet in 51 holes, and Victoria—267,343 feet in 27 holes.

Expenditures on petroleum exploration, development, and production in 1968, the most recent year for which details are available, totaled $159.4 million. Private enterprise contributed $137.7 million, and Commonwealth and State Governments $21.7 million (exclusive of $15.5 million subsidy payments by the Commonwealth Government to companies). Approximately half ($68.2 million) of the private enterprise contribution went to Victoria offshore activities. The total $82.8 million spent by private industries in Western Australia was distributed 57 percent to inland and 43 percent to offshore projects.

In 1969 Commonwealth Government assistance to private companies under the Petroleum Search Subsidy Act amounted to $16.7 million. A legislative amendment that became effective on September 30, 1969, prohibits subsidy payment to offshore oil exploration ventures in which there is no Australian equity. And stratigraphic drilling, which previously qualified for a 40-percent subsidy has been limited to 30 percent.

National reserves of crude oil at yearend 1969 were estimated at 1,827 million barrls, compared with 1,715 million for 1968. Natural gas reserves were put at 15,125 billion cubic feet on December 31, 1969, an increase of 59 percent during the year.

According to the Petroleum Information Bureau,[7] the yearend capacity of Australia's 10 petroleum refineries was 613,000 barrels per stream-day, which is equivalent to 28.01 million tons per year. Output of refinery products in 1969 totaled 168.4 million barrels, compared with 151.1 million in 1968. Consumption of refined products during the year totaled 178.8 million barrels. Principal consumer categories included: Automotive fuel—34 percent, furnace fuel—26 percent, automotive distillate—11 percent, and refinery fuel—9 percent. Foreign trade in refinery products included imports totaling 16.0 million barrels and exports totaling 5.6 million barrels.

[7] Australian Information Bureau (Australia). Petroleum Gazette. Melbourne, Australia. V. 16, No. 2, June 1970.

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The Mineral Industry of Austria

By Roman V. Sondermayer [1]

During 1969 Austria produced aluminum, copper, lead and zinc, steel, cement, graphite, magnesite, salt, crude oil, natural gas and other mineral commodities. Except for magnesite and graphite, production was not significant by world standards and imports of raw minerals and fuels were essential to sustain the industrial economy. Domestic output of many minerals went up, reflecting the general economic expansion in Austria and Europe. Gains in production were related to better utilization of existing facilities rather than to construction of new ones.

Austria's mineral economy contributed about 2 percent to the gross national product (GNP). The value of crude mineral production by major segments of the industry in million dollars was as follow:

Commodity group	1967	1968	1969 *
Petroleum and natural gas	$91.2	$84.4	$90.0
Stone and industrial minerals	73.2	71.6	80.0
Coal	34.2	31.6	30.0
Metallic ores	37.4	27.8	30.0
Salt and brine	8.4	8.1	10.0
Total	r244.4	223.5	240.0

* Estimate. r Revised.

There were no major mineral discoveries or new plant construction in 1969. While the actual investments were small, Austrians were planning additions to the aluminum smelter at Ranshofen and to the petroleum refinery at Schwecht. At yearend the planning was completed but some financial problems were not resolved.

[1] Petroleum engineer, Bureau of Mines, Washington, D.C.

PRODUCTION AND TRADE

Production of minerals and related commodities had a slightly upward trend in 1969. Gains in output reflected favorable economic conditions in Austria and were results of modernization of some facilities.

Trade in minerals in 1968, the latest year for which data were available, remained at the same order of magnitude when compared with trade value in 1967. The iron and steel industry had the largest share of total mineral trade and West Germany was the principal trading partner.

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Table 1.—Austria: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Aluminum:			
Alumina, gross weight	24,000	24,337	e24,000
Metal:			
Primary	78,754	85,898	89,676
Secondary	24,108	24,258	25,716
Antimony:			
Mine output, metal content	690	703	700
Metal	665	722	NA
Cadmium, metal	19	19	25
Copper:			
Mine output, metal content of ore	1,906	2,112	2,354
Metal, refined, including secondary	18,276	18,110	19,325
Germanium, metal content of concentrates-kilograms	8,850	7,400	e7,000
Iron and steel:			
Iron ore and concentrates ---thousand tons---	3,473	r3,482	3,982
Pig iron ---do---	2,140	2,474	2,816
Ferroalloys ---do---	5	5	5
Steel ingots and castings ---do---	3,023	3,467	3,926
Steel semimanufactures ---do---	2,226	e2,560	2,870
Lead:			
Mine output, metal content of ore	5,638	6,780	6,807
Metal including secondary	13,154	13,051	14,724
Manganese, content of iron ore	67,760	67,911	NA
Silver, metal, including secondary --troy ounces--	125,709	160,753	128,603
Tungsten, mine output, WO_3 content	68	176	e170
Zinc:			
Mine output, metal content of ore	11,160	12,660	14,234
Metal, refined, including secondary	14,157	15,294	15,532
NONMETALS			
Barite	2,456	1,461	708
Cement, hydraulic ---thousand tons---	4,548	4,553	4,558
Clays:			
Bentonite	960	510	---
Illite	136,500	172,406	e170,000
Kaolin	383,779	327,145	348,072
Other	46,650	68,988	e68,000
Diatomite	3,657	2,979	1,765
Feldspar	2,480	2,174	1,806
Graphite, crude	31,541	25,468	25,825
Gypsum and anhydrite, crude, ---thousand tons---	738	698	676
Lime ---do---	693	e720	617
Magnesite:			
Crude ---do---	1,535	1,547	1,608
Sintered or dead burned ---do---	450	482	526
Caustic, calcined ---do---	176	175	183
Quarts and quartzite	r50,393	r62,562	124,216
Salt:			
Rock	899	963	926
Evaporated	190,973	200,808	224,934
In brine e ---thousand tons---	233	240	250
Stone, n.e.s.:			
Building ---do---	949	55	44
Crushed ---do---	7,398	e7,250	7,265
Sand and gravel, n.e.s. ---do---	4,474	5,280	5,489
Sulfur, elemental, all forms	31,550	31,875	40,981
Talc and soapstone	77,733	84,554	94,138
MINERAL FUELS AND RELATED MATERIALS			
Coal, brown coal and lignite ---thousand tons---	4,604	4,192	3,840
Coke, all types ---do---	1,620	1,713	1,743
Gas:			
Manufactured, all types [1] ---million cubic feet---	65,649	70,523	e71,000
Natural gas ---do---	r63,460	r57,562	52,371
Petroleum:			
Oil shale ---thousand tons---	598	400	510
Crude oil, from wells ---do---	2,685	2,724	2,758
Refinery products:			
Gasoline, all kinds ---do---	888	850	924
Kerosine and jet fuels ---do---	78	90	95
Distillate fuel oils ---do---	895	1,019	1,096
Residual fuel oils ---do---	2,028	2,279	2,428
Lubricants, all kinds ---do---	184	253	269
Asphalt and bitumen ---do---	244	240	255
Other products ---do---	88	97	119
Total ---do---	4,355	4,828	5,186
Refinery fuel ---do---	98	63	NA
Refinery losses ---do---	76	82	NA

e Estimated. p Preliminary. r Revised. NA Not available.

[1] Include blast furnace and coke oven gas. Manufactured gas is reported in original source as gas having a calorific value of 4,200 calories per cubic meter.

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Table 2.—Austria: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum metal, including alloys:			
Scrap	5,899	9,184	West Germany 5,361.
Unwrought	23,593	24,804	West Germany 17,628; Italy 2,145.
Semimanufactures	24,210	27,110	West Germany 5,329; United Kingdom 3,718.
Antimony ore and concentrate	r472	396	Belgium-Luxembourg 284.
Cadmium metal, including alloys, all forms ---kilograms	700	500	West Germany 300.
Chromite	516	238	West Germany 288.
Columbium and tantalum:			
Tantalum metal, including alloys, all forms ---kilograms	2,700	5,600	Poland 2,100; West Germany 1,200.
Copper:			
Ore and concentrate	2,920	1,110	All to West Germany.
Metal including alloys:			
Scrap	302	236	West Germany 170.
Unwrought	4,541	5,077	West Germany 4,145.
Semimanufactures	7,354	7,132	Bulgaria 1,311; Sweden 1,205.
Gold metal, unworked or partly worked	r18,455	14,661	West Germany 9,517.
Iron and steel:			
Iron ore and roasted pyrites	395	581	Belgium-Luxembourg 550.
Metal:			
Scrap	11,560	6,118	Switzerland 2,772; Italy 2,073.
Pig iron, ferroalloys, and similar materials thousand tons	14	20	Italy 15.
Steel:			
Primary forms ---do	362	460	West Germany 369; United Kingdom 43.
Semimanufactures:			
Bars, rods, angles, shapes, sections ---do	189	187	West Germany 84; Italy 25; Hungary 21.
Universals, plates, and sheets ---do	514	527	West Germany 143; U.S.S.R. 103.
Hoop and strip ---do	68	70	Switzerland 35; West Germany 6.
Rails and accessories ---do	23	52	Switzerland 15; Senegal 9.
Wire ---do	44	51	Hungary 15; Switzerland 6.
Castings and forgings, rough ---do	3	3	West Germany 1.
Lead:			
Oxides	1,331	1,427	Czechoslovakia 1,219.
Metal, including alloys, all forms	r2,808	1,600	Italy 1,481.
Magnesium metal, including alloys, all forms	320	332	West Germany 169; United Kingdom 75.
Manganese oxide	351	347	Brazil 192.
Mercury ---76-pound flasks	328	490	West Germany 354.
Molybdenum metal, including alloys, all forms	363	500	West Germany 177; Hungary 171.
Nickel metal, including alloys, all forms	r217	244	West Germany 152.
Platinum group metals and silver metal, including alloys, all forms:			
Platinum group troy ounces	6,302	20,898	United Kingdom 16,397; West Germany 1,897.
Silver:			
Bullion thousand troy ounces	141	180	All to West Germany.
Semimanufactures do	93	186	Yugoslavia 129.
Rare-earth oxide	221	133	NA.
Tin:			
Oxide ---long tons	78	64	Czechoslovakia 39.
Metal, including alloys, all forms ---do	r23	30	Denmark 11.
Tungsten:			
Ore and concentrate	164	279	All to West Germany.
Metal, including alloys, all forms	96	91	West Germany 59; Italy 5.
Zinc:			
Ore and concentrate	---	3	NA.
Metal, including alloys, all forms	6,928	4,788	Italy 4,203.

See footnotes at end of table.

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Table 2.—Austria: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS—Continued			
Other:			
Ore and concentrate	r138	139	All to West Germany.
Ash and residues containing nonferrous metals	17,081	20,366	Italy 9,393; West Germany 6,355.
NONMETALS			
Asbestos	13	57	Yugoslavia 24; Rumania 12.
Barite and witherite	61	---	
Cement	9,487	10,321	West Germany 9,921.
Chalk	3,273	3,408	West Germany 2,006.
Clays and clay products (including all refractory brick):			
Crude clays:			
Kaolin (china clay)	27,813	26,808	Italy 17,317; Switzerland 6,883.
Other	1,838	1,563	United Kingdom 761; Rumania 367.
Products:			
Refractory (including nonclay bricks)	140,794	159,628	West Germany 33,107; Sweden 17,943.
Nonrefractory	1,155	1,042	West Germany 768.
Cryolite and chiolite, natural	4	38	All to Mexico.
Diamonds, industrial --thousand carats--	---	25	All to Yugoslavia.
Diatomite and other infusorial earths	2,355	2,146	United States 820; West Germany 796.
Feldspar	r411	293	West Germany 265.
Fluorspar	20	22	NA.
Graphite, natural	18,210	24,720	Italy 9,644; Poland 6,592.
Lime	3,369	4,074	West Germany 3,661.
Magnesite	263,319	250,761	West Germany 165,759; Hungary 17,375.
Mica, all forms	12	42	Rumania 36.
Pigments, mineral	3,406	4,799	West Germany 1,805; United Kingdom 1,420.
Salt	4	36	Yugoslavia 24.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous, including marble and limestone	110,037	95,806	West Germany 79,163.
Slate	51	40	NA.
Other	44,407	54,313	West Germany 45,836.
Worked:			
Paving and flagstone	11,589	23,742	West Germany 17,362.
Other	523	2,131	West Germany 1,227.
Dolomite	r32,295	8,544	United Kingdom 4,386; West Germany 2,156.
Gravel and crushed rock	258,683	337,755	West Germany 175,991.
Limestone	340,986	291,299	All to West Germany.
Quartz and quartzite	270	42	Mainly to West Germany.
Sand, excluding metal bearing	56,440	54,684	West Germany 42,664; Switzerland 9,351.
Talc, steatite, soapstone and pyrophyllite	61,748	72,861	West Germany 33,491; Italy 11,203.
Other nonmetals, n.e.s.:			
Crude	3,006	2,668	West Germany 2,300; Italy 146.
Slag dross and similar waste, not metal bearing	97,457	153,459	Mainly to West Germany.
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets:			
Lignite and lignite briquets	15,366	9,192	West Germany 9,189.
Coke and semicoke	48,280	124,934	Rumania 103,846.
Petroleum refinery products:			
Kerosine and jet fuel	10,168	12,003	All to Poland.
Distillate fuel oil	8,109	783	West Germany 607.
Lubricants	79,353	100,962	Poland 41,595; Syria 4,671.
Mineral jelly and wax	23	24	Mainly to Switzerland.
Other	r13,708	24,534	Yugoslavia 1,176; Belgium-Luxembourg 349.
Mineral tar and other coal, petroleum, or gas derived chemicals	r4,895	6,050	West Germany 4,465; Italy 861.

r Revised. NA Not available.

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Table 3.—Austria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum:			
Bauxite	30,948	25,052	Surinam 15,246.
Oxide and hydroxide	174,845	197,242	West Germany 12,290; Poland 6,548.
Metals, including alloys:			
Unwrought, including scrap	r8,254	10,077	Czechoslovakia 3,030; Poland 1,885.
Semimanufactures	7,262	6,810	West Germany 3,089.
Antimony metal, including alloys, all forms	128	129	Belgium-Luxembourg 94; United Kingdom 17.
Arsenic trioxide, pentoxide, and acids	21	32	Mainly from United Kingdom.
Beryllium metal, including alloys, all forms ..kilograms	200	NA	
Cadmium metal, including alloys, all forms	9	11	West Germany 7.
Chromium:			
Chromite	36,989	54,540	Turkey 28,017; Iran 11,711.
Oxide and hydroxide	108	180	West Germany 141.
Columbium and tantalum:			
Tantalum metal, including alloys, all forms ..kilograms	4,000	9,500	United States 7,200.
Copper:			
Ore and concentrate	2,920	1,110	All from West Germany.
Metal, including alloys:			
Scrap	4,828	6,709	West Germany 4,242.
Unwrought	r20,739	22,501	West Germany 12,682; Republic of South Africa 4,024.
Semimanufactures	5,343	4,955	West Germany 2,229; Switzerland 629.
Gold metal, unworked and partly worked ..thousand troy ounces	1,621	996	United Kingdom 764; Switzerland 182.
Iron and steel:			
Ore and concentrate, except roasted pyrite ..thousand tons	904	1,375	Brazil 1,006.
Roasted pyrite ..do	335	245	Italy 225.
Metal:			
Scrap ..do	13	61	East Germany 42; Poland 10.
Pig iron, including cast iron [1] ..do	101	116	U.S.S.R. 49; Hungary 32.
Ferroalloys:			
Ferromanganese ..do	11	16	Norway 10; U.S.S.R. 1.
Other ..do	30	36	Norway 6; U.S.S.R. 5.
Steel:			
Primary forms ..do	98	170	Rumania 99; Hungary 30.
Semimanufactures:			
Bars, rods, angles, shapes, sections ..do	r45	58	West Germany 33.
Universals, plates, and sheets ..do	72	66	West Germany 22; Belgium-Luxembourg 14.
Hoop and strip ..do	8	10	West Germany 4; Belgium-Luxembourg 2.
Rails and accessories ..do	1	2	Mainly from West Germany.
Wire ..do	8	10	West Germany 5; Belgium-Luxembourg 2.
Tubes, pipes, and fittings ..do	76	75	West Germany 50; Switzerland 7.
Castings and forgings, rough ..do	7	5	West Germany 3.
Lead:			
Ore and concentrate	3,100	2,594	All from Italy.
Oxides	181	189	United Kingdom 96.
Metals, including alloys:			
Unwrought, including scrap ..do	13	61	Yugoslavia 10,541; West Germany 2,121.
Semimanufactures	358	686	Yugoslavia 288; Switzerland 229.
Magnesium metal, including alloys, all forms	539	896	Czechoslovakia 384; Italy 293.

See footnotes at end of table.

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Table 3.—Austria: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS—Continued			
Manganese:			
Ore and concentrate	589	807	Morocco 319; Netherlands 266.
Oxides	174	260	Japan 226.
Mercury ——76-pound flasks	325	206	Italy 73; West Germany 46.
Molybdenum:			
Oxides	337	496	West Germany 446.
Metal, including alloys, all forms	r10	4	Hungary 2.
Nickel:			
Matte, speiss, and similar materials	711	758	United Kingdom 468.
Metals, including alloys:			
Unwrought, including scrap	r2,017	2,625	United Kingdom 1,372.
Semimanufactures	524	580	West Germany 270.
Platinum-group metals and silver:			
Waste and sweepings ——troy ounces	354	5,048	Switzerland 2,411.
Metal, including alloys:			
Platinum ——do	5,916	7,620	West Germany 6,816; United Kingdom 386.
Silver:			
Bullion ——do	3,273	2,363	United Kingdom 733; West Germany 617.
Semimanufactures ——do	215	312	West Germany 158.
Tin metal, including alloys, all forms:			
Unwrought, including scrap ——long tons	528	556	Netherlands 313; West Germany 79.
Semimanufactures ——do	83	57	Switzerland 24.
Titanium oxide	5,766	6,357	West Germany 3,823; United Kingdom 1,456.
Tungsten:			
Ore and concentrate	2,658	2,392	Mainland China 1,732; Republic of South Korea 329.
Oxide and hydroxide	214	276	West Germany 168.
Metal, including alloys, all forms	r85	90	West Germany 70.
Uranium oxides, including rare-earth oxides	777	587	Brazil 500.
Zinc:			
Ore and concentrate	13,248	10,218	All from Italy.
Oxide	526	699	West Germany 584.
Metal, including alloys:			
Unwrought	5,576	6,604	West Germany 1,791; Yugoslavia 1,384; Poland 1,283.
Blue powder	636	579	Yugoslavia 370; United Kingdom 105.
Semimanufactures	136	195	West Germany 66; United Kingdom 43.
Other:			
Ore and concentrate	r5,872	5,426	United States 1,864; Canada 1,393.
Ash and residue containing nonferrous metals	24,770	24,205	West Germany 10,500; Poland 5,968.
Other ash and slag, n.e.s.	1,298	1,263	West Germany 902.
NONMETALS			
Abrasives, natural, n.e.s:			
Pumice, emery, natural corundum, etc.	r419	606	West Germany 305.
Dust and powder of precious and semiprecious stone	6,130	210	NA.
Grinding and polishing wheels and stones	576	651	West Germany 391.
Asbestos	17,475	31,746	Canada 17,745; Republic of South Africa 6,598.
Barite and witherite	7,334	5,724	Yugoslavia 2,948.
Boron materials, crude natural borates	8,146	8,332	United States 7,056.
Cement	19,622	20,518	West Germany 5,117; France 4,886.
Chalk	775	1,503	France 1,121.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s:			
Bentonite	2,810	329	Hungary 156.

See footnotes at end of table.

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Table 3.—Austria: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS—Continued			
Clays and clay products (including all refractory bricks)—Continued			
Crude clays, n.e.s.—Continued			
Kaolin (china clay)	28,403	31,765	West Germany 14,283; United Kingdom 12,400.
Other	73,031	67,681	West Germany 38,285.
Products:			
Refractory (including nonclay bricks)	12,619	12,861	West Germany 11,079.
Nonrefractory	119,770	117,371	Italy 45,563; West Germany 45,278.
Cryolite and chiolite, natural	357	259	Denmark 258.
Diamond, industrial—thousand carats	205	80	All from West Germany.
Diatomite and other infusorial earths	2,355	2,146	United States 820; West Germany 796.
Feldspar	7,028	6,216	West Germany 2,938; Sweden 1,696.
Fertilizer:			
Crude:			
Phosphatic	274,717	321,849	United States 160,835; Israel 48,024.
Potassic	91,037	60,140	East Germany 55,300.
Other	1,269	1,636	West Germany 1,061.
Manufactured:			
Phosphatic	306,955	327,795	France 148,296; Belgium-Luxembourg 137,901.
Potassic	227,123	254,182	East Germany 89,995; West Germany 78,570.
Other, including mixed	1,750	2,045	West Germany 1,875.
Fluorspar	13,551	15,426	East Germany 6,704; West Germany 5,202.
Graphite, natural	298	694	North Korea 497.
Gypsum and plasters	27,508	30,612	East Germany 11,134; Poland 10,146.
Lime	496	454	West Germany 423.
Magnesite	27,775	43,105	Turkey 31,402.
Mica:			
Crude, including splittings and waste	237	437	Rumania 147; West Germany 83.
Worked, including agglomerated splittings	32	32	Switzerland 17.
Pigments, mineral:			
Natural, crude	202	290	France 237.
Iron oxides, processed	1,621	1,629	West Germany 1,589.
Precious and semiprecious stone (including diamonds):			
Natural—thousand carats	62,910	67,375	United States 27,310; Brazil 19,855.
Manufactured —do—	11,260	19,425	France 9,660.
Pyrite (gross weight)	24,912	25,952	U.S.S.R. 16,847; Italy 5,051.
Salt, including brine salt	22	6,540	Rumania 3,917.
Stone, sand and gravel:			
Dimension stone:			
Crude or partly worked:			
Calcareous	8,569	8,512	Italy 5,629.
Slate	607	718	East Germany 140; France 80.
Other	28,024	27,904	Italy 15,276; Republic of South Africa 5,626.
Worked:			
Paving and flagstone	9,850	9,314	Yugoslavia 7,523.
Other	3,325	3,640	Italy 2,869.
Dolomite, chiefly refractory grade	r3,307	3,506	Italy 2,487.
Gravel and crushed rock	100,849	50,609	West Germany 38,272.
Limestone, except dimension	r496	454	West Germany 423.
Quarts and quartsite	15,320	15,226	West Germany 13,270.
Sand, excluding metal bearing	145,503	150,544	West Germany 120,205; East Germany 11,929.
Sulfur:			
Elemental	r89,184	83,889	Poland 29,921; United States 16,190.
Sulfur dioxide	1,081	698	West Germany 503.
Sulfuric acid	6,103	9,053	West Germany 5,506.
Talc, steatite, soapstone, and pyrophillite	1,223	1,718	Italy 886.

See footnotes at end of table.

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Table 3.—Austria: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS—Continued			
Other nonmetals, n.e.s:			
Crude			
Slag dross and similar waste	8,282	7,279	Italy 3,784; Hungray 1,641.
Oxides and hydroxides of magnesium, strontium, and barium	365	521	West Germany 334.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,091	879	Trinidad and Tobago 575.
Carbon black	11,717	13,542	Italy 4,004; West Germany 3,961.
Coal and briquets:			
Anthracite and bituminous coal —thousand tons	r3,124	3,365	Poland 1,246; West Germany 893.
Briquets of anthracite and bituminous coal —do	41	42	Poland 17; Netherlands 10.
Lignite and lignite briquets —do	574	495	East Germany 277.
Coke and semicoke —do	967	1,018	West Germany 358; Czechoslovakia 322.
Gas, hydrocarbon:			
Natural	978	200,706	U.S.S.R. 100,316.
Manufactured	1,454	1,443	Mainly from West Germany.
Peat, including peat briquets	21	17	West Germany 11.
Petroleum:			
Crude and partly refined —thousand tons	1,091	1,496	U.S.S.R. 823; Yugoslavia 299.
Refinery products:			
Gasoline (including natural) —do	588	714	Italy 272; West Germany 154.
Kerosine and jet fuel —do	7	5	Mainly from Italy.
Distillate fuel oil —do	115	106	Italy 86; West Germany 10.
Residual fuel oil —do	1,228	1,684	West Germany 540; Hungary 240.
Lubricants —do	57	59	Italy 20; West Germany 16.
Mineral jelly and wax —do	8	9	West Germany 5.
Other —do	327	262	Italy 83; Hungary 77.
Mineral tar and other coal, petroleum, or gas derived chemicals —do	16	9	West Germany 3; U.S.S.R. 2.

r Revised. NA Not available.
[1] Includes spiegeleisen, shot, powder, and sponge.

COMMODITY REVIEW

METALS

Aluminum.—Production of primary aluminum continued to be based entirely on imported bauxite. The production increase (4.4 percent) was largely due to a full year's operation of the additional electrolytic capacity installed in 1968 at the 80,000-ton-per-year Ranshofen aluminum smelter operated by the nationalized Vereinigte Metallwerke Ranshofen-Berndorf (VMRB). Austria's second and much smaller aluminum refinery, located near Lend, Salzburg province, was operated by Salzburger Aluminium G.m.b.H. (SAG), a wholly owned subsidiary of Alusuisse.

In mid-1969 the managment of VMRB announced a new investment program. The program will last 5 to 10 years and will cost US $650 million.[2] Upon completion of the program, the facilities at Ranshofen will have the following annual capacities: Electrolytic plant, 130,000 tons; rolling mill, 50,000 tons; and extrusion plant, 14,000 tons. In addition, a new aluminum powder plant with a capacity of 6,000 tons of raw powder per year was planned. Production at the powder plant was scheduled to begin in early 1971.

Iron and Steel.—The supply of domestic iron ore was not adequate to cover demand, and significant imports were necessary (about 35 percent of total consumption). Some of the difficulties in supplying the iron and steel industry with domestic iron ore were resolved during 1969. The Österreichisch-Alpine Montangesellschaft A.G. (ÖAMG) accounted for 87 percent of domestic ore production. According to the

[2] Where necessary values have been converted from Austria shillings (As) to U.S. dollars at the rate of As26.3=US$1.00

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Government-owned Vereinigte Österreichische Eisen und Stahlwerke A.G. (VOEST), the Montan ore was expensive and low grade; therefore, VOEST was not willing to renew purchases in 1969. However, after arbitration by other Government agencies a new contract was concluded committing VOEST to the purchase of 1.4 million tons of ore annually for 5 years. As a part of the agreement ÖAMG agreed to improve the quality of the delivered ore.

The iron and steel industry remained one of the most important elements in the country's economy. During the year, increased domestic and foreign demand for steel led to near-capacity production, and an increase in output by 14.6 percent over 1968. The economic upswing has brought about an increased investment activity primarily directed toward rationalization and technical improvements. About 86 percent of the domestic steel output came from the integrated iron and steel plants operated by VOEST and ÖAMG.

Other Metals.—During 1969 Austria also produced antimony, cadmium, copper, lead, silver, tungsten, and zinc. A substantial part of this production of the metals was based on imported ores, concentrates, and raw metals. During 1969 no significant new facilities were built for metal production.

MINERAL FUELS

During 1969 Austria remained a modest producer of low-rank coals, crude oil, and natural gas. Domestic supplies were not adequate to meet the country's requirements, and imports were necessary. To assure an uninterruped production of energy the Austrian Government started to develop a coordinated energy plan, to be completed in early 1970. Details of the plan were not available. The plan is based on the principle of securing a sufficient supply at reasonable cost.

The overall consumption of energy in Austria increased during 1969. Consumption of coal was relatively unchanged from the level of 1968; and consequently, the shares of liquid fuels and natural gas increased to about 50 percent of the total energy consumption in the expanded energy market.

Coal.—In 1969 the foremost problem of Austrian energy policy was adaptation of indigenous brown coal production to the changing structure of the energy market. Competition from oil and natural gas led to difficulties in sales of brown coal, and Government subsidies were necessary. To keep subsidies as low as possible rationalization programs went into effect, resulting in mine closures and lower total production. Coal output came from 11 operations with a total labor force of about 7,100 persons. Three companies, Graz-Köflacher Eisenbahn und Bergbaugesellschaft, Salzach-Kohlenbergbau, G.m.b.H., and Wolfsegg-Traunthaler-Kohlenwerk Aktiengesellschaft were among the principal coal producers.

Petroleum and Natural Gas.—Although a producer of crude oil and natural gas, Austria imported significant quantities of both commodities during 1969 because the demand exceeded domestic output.

Four companies were significantly involved in the exploration and production of oil in Austria in 1969. The following tabulation indicates the approximate percentage share of each company in the total concession area and in the country's production:

Company	Concession area (percent)	Production	
		Crude oil	Natural gas
Allgemeine Österreichische Mineralölverwaltung Aktiengesellschaft (ÖMV)	68	86	99
Rohöl Gewinungs Aktiengesellschaft (RAG)	21	14	1
Mesa Petroleum Aktiengesellschaft (MESA)	14	--	--
Voralberg Erdöl und Ferngas Gesellschaft	2	--	--

During 1969 about 1,450 oil and 140 gas wells were in production in Austria. Four refineries Allgemeine Österreichische Mineralölverwaltung Aktiengesellschaft (ÖMV), at Schwechat (88,000 barrels per day); Mobil Oil Austria A.G., at Kagran (4,500 barrels per day); Shell-Austria A.G., at Floridsdorf (4,600 barrels per day) and a small one in Neusiedl provided a total refinery capacity of more than 97,100 barrels per day.

The principal events in the petroleum and gas industries included expansion planning for the country's largest refinery at Schwecht and evaluation of a gasfield at Schönkirchen. Capacity of the Government-owned Schwecht refinery will be expanded by 70,000 barrels per day at a

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cost of about US $8.6 million. To increase the supply of crude oil in Austria, construction of the 18-inch, 260-mile spur from the Transalpine pipeline to Vienna was continued. The spur was due for completion in the fall of 1970.

Evaluation of the Schönkirchen Tief gasfield continued during 1969. The second well (T-42), about 4,000 feet southwest of the discovery well, was completed at the depth of 18,662 feet in dolomite. The gas zone, about 980 feet thick, was penetrated at a depth of 17,400 feet. The discovery well (T-32) went into production during 1969 at a rate of 14 million cubic feet per day.

The first year of Soviet deliveries of natural gas to Austria was completed without problems. About 28,000 million cubic feet of gas was delivered from Bratislava, Czechoslovakia.

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The Mineral Industry of Belgium and Luxembourg

By Roman V. Sondermayer [1]

The mineral industry of Belgium-Luxembourg was primarily devoted to processing imported ferrous, nonferrous, and petroleum raw materials. During 1969 Belgium-Luxembourg remained an important supplier, mostly to other European countries, of iron and steel, copper, lead, zinc, and refined petroleum products. Belgium's domestic mine output is limited to a little iron ore and considerable quantities of coal and quarry products. Luxembourg has been primarily a producer of iron and steel mostly from domestic iron ore, and to a lesser extent a producer of construction materials.

BELGIUM

PRODUCTION

The mineral industry production pattern in 1969 showed no clear trend. Coal, quarry products, and small quantities of iron ore were the only minerals mined in the country. The output of the coal industry continued to decline in 1969, the result of strong competition from liquid fuels, natural gas, and foreign coal and reduced Government subsidies. The industry continued the planned closing of mines because high production costs rendered Belgian coal uncompetitive in European Economic Community (EEC) markets.

Most of the quarry products (clays, stone, sand and gravel) were mined at about the same level of output as in 1968, and the demand for them was adequate.

The only significant changes in the Belgian mineral industry occurred in the iron and steel and petroleum refining industries. Several iron and steel plants were modernized and rationalized and two refineries were expanding capacities. Steel output rose about 12 percent during the year, principally because new plants were attaining full operating capacity. In the petroleum industry two refineries were expanded by Rafinerie Belge (Société Industrielle Belge des Pétroles S.A.) and International Oil. In addition the Chevron company will build a new 5-million-ton-per-year refinery at Feluy. During 1969 most of the nonferrous metals showed insignificant changes in output levels as compared with figures for previous years. The entire mineral industry employed about 130,000 persons in 1969.

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[1] Petroleum engineer, Bureau of Mines, Washington, D.C.

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Table 1.—Belgium: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 • p
METALS			
Aluminum, metal, secondary only	NA	• 2,500	2,500
Cadmium	• 800	r 800	800
Copper, refined, including secondary	317,873	343,180	298,675
Iron and steel:			
Iron ore and concentrate thousand tons	88	83	93
Pig iron including ferroalloys do	8,902	10,371	11,316
Steel:			
Ingots and castings do	9,716	11,486	12,831
Semimanufactures do	7,511	8,650	9,810
Lead, metal, including secondary	107,800	95,500	110,543
Precious metals, unworked thousand troy ounces	15,561	NA	46,850
Tin metal, including secondary long tons	r 6,069	5,048	6,474
Zinc metal, including secondary	227,328	254,300	260,593
Other nonferrous metals, n.e.s	3,950	4,000	4,000
NONMETALS			
Cement, hydraulic thousand tons	5,820	6,000	NA
Clays do	167	160	NA
Gypsum and anhydrite, calcined	73,295	74,000	NA
Lime and dead burned dolomite:			
Quicklime thousand tons	2,284	2,300	2,300
Dead burned dolomite do	304	305	305
Quartz:			
Quartzite do	298	300	NA
Glass sand do	1,530	1,600	NA
Stone, sand and gravel, n.e.s.:			
Limestone and other calcareous do	15,039	NA	14,128
Marble:			
In blocks cubic meters	5,090	r 4,500	5,000
Slabbed	8,641	• 8,700	8,800
Crushed and other	33,403	• 34,000	35,000
Petit granite (Belgian bluestone):			
Quarried cubic meters	286,708	r 266,000	270,000
Sawed do	75,930	r 64,000	65,000
Worked do	15,341	r 12,000	14,000
Crushed and other do	232,903	233,000	240,000
Porphyry all kinds thousand tons	5,523	• 5,600	6,755
Sand and gravel:			
Construction sand do	4,467	• 4,500	5,000
Foundry sand do	1,089	• 1,100	1,200
Other sand do	1,141	• 1,200	1,300
Gravel (dredged) do	5,367	• 5,400	5,400
Sandstone:			
Rough stone, including crushed do	1,445	• 1,500	1,500
Paving and mosaic stone	9	9	10
Other	107	• 107	110
Slate, roofing and other	8,607	• 8,600	9,000
Sulfur, byproduct (recovered)	• 5,000	• 5,000	5,000
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite thousand tons	4,993	4,321	3,595
Bituminous do	11,442	10,486	9,605
Coke, all kinds do	6,857	7,243	NA
Fuel briquets all kinds do	868	823	NA
Gas, manufactured, all types tera calories [1]	r 32,096	34,385	NA
Petroleum refinery products:			
Gasoline:			
Aviation thousand 42-gallon barrels	71	45	NA
Motor do	18,228	r 21,691	22,000
Kerosine do	2,017	3,372	NA
Jet fuel do	5,203	4,740	NA
Distillate fuels do	35,586	r 51,467	52,000
Residual fuels do	43,062	r 56,523	58,000
Lubricants do	301	381	NA
Other do	12,618	19,962	NA
Total do	117,086	158,181	NA

• Estimate. p Preliminary. r Revised. NA Not available.

[1] One tera calorie = 238.095 cubic meters at 4,200 kilocalories per cubic meter.

TRADE

The foreign trade of Belgium is combined with that of Luxembourg in the official returns of the Belgium-Luxembourg Economic Union (BLEU). Minerals again occupied an important position in Belgium-Luxembourg's total trade.

Among Belgium-Luxembourg's mineral

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exports the largest commodity group was products of the iron and steel industry (of which Luxembourg contributed a significant share). Other mineral exports, in the order of importance, were nonferrous metal products, diamonds, other precious stones and gems, and mineral fuels.

Mineral fuels were the largest commodity group among imports. The principal trading partners of Belgium-Luxembourg were the member countries of the EEC and the United States. Details on trade are shown in tables 2 and 3.

Table 2.—Belgium-Luxembourg: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum:			
Bauxite and concentrate	------	21	NA.
Metals, including alloys:			
Scrap	9,897	11,464	West Germany 5,219.
Unwrought	6,819	7,143	West Germany 6,729.
Semimanufactures	103,139	114,458	United States 36,572; West Germany 17,392; Netherlands 15,042.
Bismuth metal, including alloys, all forms	61	158	France 86.
Cadmium metal, including alloys, all forms	656	861	West Germany 524; France 165.
Chromium:			
Chromite	65	1,924	France 1,844.
Metal, including alloys, all forms	------	4	NA.
Copper:			
Ore and concentrate	8,187	10,276	Bulgaria 5,502.
Metal, including alloys, all forms:			
Scrap	14,338	16,003	Netherlands 7,141; France 2,912.
Unwrought	286,407	309,827	France 88,757; West Germany 58,386; Netherlands 56,113.
Semimanufactures	174,452	220,032	Netherlands 108,380; United States 20,986.
Germanium metal, including alloys, kilograms	7,300	5,800	Mainland China 2,000; Italy 1,800.
Gold metal, unworked or partly worked, thousand troy ounces	130	548	Switzerland 272; United States 135.
Iron and steel:			
Ore and concentrate, except roasted pyrite, thousand tons	62	17	France 17.
Roasted pyrite, do.	230	271	West Germany 270.
Metal:			
Scrap, do.	818	743	West Germany 432; France 171.
Pig iron, including cast iron, sponge iron, powder and shot, thousand tons	97	85	France 53.
Ferroalloys, do.	67	64	Italy 21; United States 16; France 11.
Steel, primary forms, do.	1,094	1,357	France 514; West Germany 382.
Semimanufactures:			
Bars, rods, angles, shapes, sections, do.	4,244	4,894	West Germany 1,422; United States 1,319; Netherlands 649.
Universals, plates and sheets, do.	3,133	3,629	West Germany 1,264; France 877; United States 246.
Hoop and strip, do.	724	765	West Germany 285; France 171.
Rails and accessories, do.	66	88	Italy 17; United States 13; Switzerland 8.
Wire, do.	325	363	United States 118; West Germany 58.
Tubes, pipes, and fittings, do.	193	218	Netherlands 64; West Germany 49; France 36.
Castings and forgings, rough, do.	58	25	West Germany 6; France 5.
Lead:			
Ore and concentrate	1,051	15	NA.
Oxides	5,810	7,176	Netherlands 5,140.
Metal, including alloys:			
Scrap	2,262	5,293	West Germany 1,876; France 1,776.
Unwrought	58,069	64,101	Netherlands 43,635; United States 12,603.
Semimanufactures	7,279	6,783	Netherlands 2,251; Sweden 739; France 414.
Magnesium metal, including alloys, all forms	176	209	United States 162.
Manganese ore and concentrates	2,586	3,019	United Kingdom 1,056; West Germany 954.
Nickel:			
Matte, speiss, and similar materials	------	16	NA.
Metals, including alloys:			
Scrap	599	811	West Germany 422; Netherlands 125.
Unwrought	24	45	France 10.
Semimanufactures	270	207	Mainly to West Europe.

See footnotes at end of table.

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Table 2.—Belgium-Luxembourg: Exports of selected mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS—Continued			
Platinum-group metals, including alloys, all forms, thousand troy ounces	15	26	United States 10.
Selenium, elemental, kilograms	32,800	24,700	Poland 6,300; Italy 5,200.
Silver metal, including alloys, thousand troy ounces	8,112	17,168	Netherlands 5,379; West Germany 4,620; France 2,977.
Tellurium and arsenic, kilograms	7,100	14,000	Netherlands 8,500.
Tin:			
Ore and concentrate, long tons	r 356	233	Spain 218.
Oxides, do	r 128	207	West Germany 103; France 50.
Metal, including alloys:			
Scrap, do	r 124	144	West Germany 80; France 33.
Unwrought, do	r 3,821	4,401	France 1,973; West Germany 880.
Semimanufactures, do	r 90	164	West Germany 65; Netherlands 20.
Tungsten:			
Ore and concentrates	6	33	Netherlands 21.
Metal, including alloys, all forms	4	2	NA.
Zinc:			
Ore and concentrate	26,853	49,973	France 32,249; Netherlands 9,661.
Metal, including alloys:			
Scrap	7,155	8,086	France 7,315.
Blue powder	36,353	40,810	West Germany 10,741; France 5,469; United States 4,377.
Unwrought	136,170	151,361	West Germany 88,111; France 12,248.
Semimanufactures	9,653	11,418	France 3,845; Italy 1,486.
Other:			
Ore and concentrate	105	1,086	Netherlands 52.
Ash and residues containing nonferrous metals:			
Lead	1,504	6,414	Netherlands 5,072.
Zinc	10,222	33,512	Netherlands 29,619; West Germany 2,226.
Other	8,695	18,853	Sweden 6,499.
Metals, including alloys, all forms	8,820	9,261	United States 3,159; Japan 1,858.
NONMETALS			
Abrasives natural, pumice, emery, natural corundum	492	855	Italy 612; Netherlands 189.
Barite and witherite	45	63	NA.
Boron materials:			
Crude natural borates	4,436	70	NA.
Oxide and acid	18	17	NA.
Cement, thousand tons	1,338	1,371	Netherlands 1,086; Cameroon 58; Gabon 30.
Chalk	103,754	110,169	Netherlands 86,163; West Germany 6,667.
Clay and clay products:			
Crude clays:			
Kaolin	1,240	1,069	NA.
Refractory	6,855	5,854	Netherlands 4,037.
Other	7,579	2,779	France 525.
Products:			
Refractory (including nonclay bricks)	21,748	21,369	France 11,036; Netherlands 4,139.
Nonrefractory, thousand tons	32	27	Netherlands 15.
Diamond:			
Gem, not set or strung, thousand carats	3,736	4,904	India 1,816; United States 968.
Industrial, do	9,795	9,991	United Kingdom 4,127; United States 1,897; Switzerland 763.
Diatomite and other infusorial earths	870	292	NA.
Fertilizer materials:			
Crude:			
Nitrogenous	44	391	NA.
Phosphatic	21,095	18,087	Netherlands 4,099; United Kingdom 2,954.
Potassic	1,242	827	NA.
Manufactured:			
Nitrogenous (nitrogen content), thousand tons	r 178	196	France 52; West Germany 50.
Phosphatic, do	r 328	328	France 138; West Germany 72; Austria 21.
Potassic, do	r 556	516	United Kingdom 85; Japan 46.
Other, do	477	936	France 592; West Germany 122.
Ammonia	61,573	147,896	France 131,417.
Fluorspar	25	469	NA.
Graphite, natural	5	33	NA.
Gypsum and plasters	10,694	10,812	Netherlands 10,055.
Lime, thousand tons	442	442	Netherlands 349.
Mica:			
Crude, including splittings and waste	88	73	NA.
Worked, including agglomerated splittings	297	395	United Kingdom 181; Switzerland 70.
Pigments, mineral, including processed iron oxides	220	175	France 59.

See footnotes at end of table.

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Table 2.—Belgium-Luxembourg: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
NONMETALS—Continued			
Precious and semiprecious stone, except diamond, including synthetic stones thousand carats	45,054	76,154	United States 32,293; West Germany 16,339.
Salt	3,869	6,556	France 6,312.
Stone, sand and gravel:			
Dimension stone, crude and partly worked, calcareous, marble, and other thousand tons	1,294	1,517	Netherlands 1,477.
Dolomite, chiefly refractory grade do	623	784	Netherlands 479.
Gravel and crushed rock do	5,477	6,336	France 2,958; Netherlands 2,619.
Limestone do	807	853	Netherlands 730.
Quartz and quartzite	71,555	84,279	Netherlands 26,670; West Germany 20,378.
Sand, including metal-bearing thousand tons	2,886	2,902	France 952; Italy 471; West Germany 257.
Sulfur:			
Elemental, all forms	10,249	4,045	West Germany 486; Brazil 389.
Sulfuric acid	83,180	69,366	France 34,096.
Talc, steatite, soapstone, and pyrophyllite	8,485	11,749	Sweden 3,047; West Germany 2,148.
Other nonmetals, n.e.s.:			
Slag, dross and similar waste, not metal bearing:			
From iron and steel manufacture thousand tons	2,143	2,443	Netherlands 1,823; France 628; Finland 80.
Slag and ash, n.e.s	81,855	119,448	Netherlands 99,147.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	196	134	NA.
Carbon black	3,221	4,260	NA.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	1,524	1,167	France 606.
Briquets of anthracite and bituminous coal do	94	100	France 75.
Coke and semicoke do	414	328	France 177; Sweden 65.
Gases, all kinds	71,776	56,570	Spain 10,789; France 9,980.
Petroleum:			
Crude and partly refined thousand tons	275	151	West Germany 151.
Refinery products:			
Gasoline, including natural do	1,400	1,610	United Kingdom 542; West Germany 407.
Kerosine and jet fuel do	239	625	Netherlands 244.
Distillate fuel oil do	4,968	1,866	West Germany 674; Netherlands 328.
Residual fuel oil do	2,455	3,295	United States 363; United Kingdom 350.
Lubricants do	174	207	Netherlands 75; Italy 20.
Mineral jelly and wax	397	598	Mainly to West Europe.
Other:			
Pitch coke	58,049	33,072	France 24,234.
Petroleum coke	32,521	27,313	United Kingdom 9,000; Norway 5,000; West Germany 5,000.
Bitumen and other residues	236,889	278,031	Netherlands 185,000; United Kingdom 44,000.

r Revised. NA Not available.

Table 3.—Belgium-Luxembourg: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum:			
Bauxite and concentrate	8,103	11,333	Guyana 6,728.
Oxide and hydroxide	14,007	12,161	West Germany 9,919.
Metals, including alloys:			
Scrap	1,729	2,120	Netherlands 608; France 358.
Unwrought	139,983	159,424	France 58,226; United States 29,980.
Semimanufactures	22,760	23,042	West Germany 12,338; Netherlands 4,777.
Antimony:			
Ore and concentrate	8,827	11,106	Bolivia 6,656; Republic of South Africa 1,667.
Metal, including alloys, all forms	110	23	France 16.
Beryllium metal, including alloys, all forms kilograms	380	200	Mainly from European Economic Community.
Bismuth metal, including alloys, all forms	91	171	Canada 78; Peru 24.

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Table 3.—Belgium-Luxembourg: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS—Continued			
Cadmium metal, including alloys, all forms	398	635	Congo (Kinshasa) 416; Netherlands 97.
Chromium:			
Chromite	2,132	14,215	Mozambique 12,262.
Oxide and hydroxide	446	505	West Germany 292; U.S.S.R. 97.
Metal, including alloys, all forms	31	52	France 29.
Cobalt oxides and hydroxides kilograms	280	300	Mainly from European Economic Community.
Copper:			
Ore and concentrate	10,778	14,432	United States 8,327.
Metal, including alloys:			
Scrap	49,348	87,122	United States 84,846; Netherlands 13,293.
Unwrought	312,571	377,476	Congo (Kinshasa) 219,499; Peru 26,023.
Semimanufactures	16,833	16,761	West Germany 7,016; Netherlands 2,858.
Germanium metal, including alloys, all forms	88	62	France 50.
Gold metal, unworked or partly worked:			
Unwrought troy ounces	1,247,942	1,097,478	United Kingdom 629,608; France 197,275.
Semimanufactures do	87,698	158,399	United Kingdom 46,326; France 42,305.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	21,874	26,336	France 13,195; Sweden 8,059; Mauritania 1,208.
Roasted pyrite do	127	152	France 865; West Germany 35.
Metal:			
Scrap do	196	283	France 151; Netherlands 66.
Pig iron, including cast iron, sponge iron, powder and shot do	192	222	West Germany 82; East Germany 52; Netherlands 27.
Ferroalloys do	107	123	France 48; Norway 45.
Steel, primary forms do	827	608	Netherlands 160; West Germany 148.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	374	450	France 224; West Germany 138.
Universals, plates and sheets do	353	407	West Germany 213; France 104.
Hoop and strip do	37	52	France 27.
Rails and accessories do	6	7	France 4.
Wire do	18	17	West Germany 9.
Tubes, pipes, and fittings do	161	109	West Germany 50; Netherlands 35.
Castings and forgings, rough do	18	4	Netherlands 2.
Lead:			
Ore and concentrate	130,159	180,723	Canada 64,793; Ireland 45,367.
Oxides	2,046	2,121	Netherlands 1,772.
Metal, including alloys:			
Scrap	8,578	11,903	Netherlands 4,589.
Unwrought	8,143	15,547	West Germany 5,619; Netherlands 3,452.
Semimanufactures	923	871	West Germany 457.
Magnesium metal, including alloys:			
Scrap	79	49	Mainly from West Europe.
Unwrought	638	934	U.S.S.R. 609.
Semimanufactures	75	83	United States 44.
Manganese:			
Ore and concentrate	285,499	306,493	Republic of South Africa 95,538; Angola 74,365; India 35,161.
Oxides	1,816	1,191	Netherlands 1,090.
Metal	219	244	Republic of South Africa 104; France 38.
Mercury 76-pound flasks	4,548	3,800	Spain 1,392; France 1,189.
Molybdenum metal, including alloys, all forms	10	10	Netherlands 4.
Nickel:			
Matte, speiss, and similar materials	50	34	Canada 20.
Metal, including alloys:			
Scrap	1,252	1,977	United States 656; France 414.
Unwrought	1,263	1,440	United Kingdom 1,049.
Semimanufactures	1,280	1,187	West Germany 336; United Kingdom 292.
Platinum-group metals, including alloys, all forms troy ounces	39,597	28,191	United Kingdom 20,072; France 3,969.
Selenium, elemental kilograms	240	9,500	NA.

See footnotes at end of table.

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Table 3.—Belgium-Luxembourg: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS—Continued			
Silver:			
Waste and sweepings, value thousands	$5,957	$9,793	United States $8,528.
Metal, including alloys, troy ounces	10,198	35,067	United States 8,546; Saudi Arabia 7,623; United Kingdom 4,823.
Tellurium, elemental, including arsenic	51	50	Sweden 48.
Tin:			
Ore and concentrate, long tons	5,943	6,407	Congo (Kinshasa) 5,334.
Oxides, do	14	18	West Germany 8.
Metal, including alloys:			
Scrap, do	17	9	NA.
Unwrought, do	2,762	2,580	Congo (Kinshasa) 1,781; Netherlands 97.
Semimanufactures, do	117	156	Netherlands 106; Italy 4.
Titanium:			
Ore and concentrate	14,877	33,149	Canada 31,551.
Oxides	11,657	9,690	West Germany 5,729; Netherlands 1,117.
Metal, including alloys, all forms	14	8	West Germany 1.
Tungsten:			
Ore and concentrate	59	108	Netherlands 49; Portugal 15.
Metal, including alloys, all forms	16	15	Netherlands 11.
Zinc:			
Ore and concentrate	525,698	622,108	Canada 348,093; Congo (Kinshasa) 68,527.
Oxide and peroxide	2,104	2,673	Netherlands 1,228.
Metals, including alloys:			
Scrap	893	1,100	West Germany 628; Netherlands 127; India 111.
Blue powder	792	1,278	West Germany 1,084.
Unwrought	14,245	19,971	Congo (Kinshasa) 7,998; Canada 3,693.
Semimanufactures	296	288	Netherlands 110.
Zirconium and hafnium metal, including alloys, all forms, kilograms	700	1,600	United States 600; France 600.
Other:			
Ore and concentrate	7,961	14,123	Morocco 8,380; Republic of South Africa 3,301.
Ash and residues containing nonferrous metals	93,761	89,553	West Germany 16,911; France 16,898.
NONMETALS			
Abrasives, natural	198,482	142,060	West Germany 140,741.
Asbestos	55,774	61,116	Canada 42,187.
Barite and witherite	5,982	6,074	France 3,805.
Boron materials, crude natural borates	16,927	17,258	Netherlands 12,156.
Bromine, kilograms	800	100	NA.
Cement	103,505	49,829	West Germany 24,829; France 6,592.
Chalk	69,455	72,065	Netherlands 39,258.
Clay and clay products:			
Crude clays:			
Kaolin	95,404	130,781	United Kingdom 85,695.
Other	249,515	279,880	West Germany 149,935; France 46,712.
Products:			
Refractory, including nonclay bricks	75,533	91,259	West Germany 54,190; Austria 11,773.
Nonrefractory	66,569	71,930	Netherlands 60,320; France 3,697.
Cryolite and chiolite	258	286	Denmark 282.
Diamond:			
Gem, not set or strung:			
Rough stones, thousand carats	6,972	9,348	United Kingdom 7,803.
Worked, do	598	833	India 292; Republic of South Africa 105; Israel 105.
Industrial, do	9,531	10,853	United Kingdom 3,845; Congo (Brazzaville) 1,719.
Diatomite and other infusorial earths	7,054	5,940	United States 1,583; Denmark 1,229.
Feldspar	34,795	40,453	Norway 14,037; France 7,550.
Fertilizer materials:			
Crude:			
Nitrogenous	15,809	23,104	Chile 22,221.
Phosphatic, thousand tons	1,469	1,805	Morocco 1,204; United States 295.
Potassic, do	1,351	1,357	France 912.
Manufactured:			
Nitrogenous	59,875	59,314	West Germany 28,013; France 21,861.
Phosphatic	364	1,458	Netherlands 1,028.
Potassic, thousand tons	706	734	France 466; West Germany 22.
Other	150,233	154,624	France 71,170; West Germany 49,060.
Fluorspar	9,932	13,241	France 8,743.
Graphite, natural	546	729	France 421; West Germany 97.
Gypsum and plasters	439,153	446,234	France 392,195.

See footnotes at end of table.

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Table 3.—Belgium-Luxembourg: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS—Continued			
Lime	88,063	113,586	France 108,245.
Magnesite	3,600	4,601	Brazil 1,199; Austria 1,144.
Mica, all forms	1,342	1,821	United Kingdom 343; Norway 288.
Pigments, mineral:			
Natural, crude	778	563	West Germany 259.
Iron oxides, processed	6,306	6,158	West Germany 5,261.
Precious and semiprecious stone, except diamond:			
Natural and manufactured grams	2,170,039	3,475,677	Tanzania 1,428,364; United States 469,924.
Dust and powder value thousands	$2,904	$2,248	Ireland $985.
Pyrite (gross weight)	276,139	352,712	Portugal 193,381; Spain 93,945.
Salt, including brine thousand tons	944	1,140	West Germany 567.
Stone, sand and gravel:			
Dimension stone and slate, including worked	16,713	16,840	France 5,518; West Germany 3,950.
Dolomite	39,760	46,190	France 36,439.
Gravel and crushed rock thousand tons	4,365	4,191	Netherlands 1,686; West Germany 1,212.
Limestone, except dimension	72,821	81,623	France 55,821.
Quartz and quartzite	12,088	17,365	West Germany 11,503; Norway 1,560.
Sand, including metal-bearing thousand tons	7,457	7,801	Netherlands 6,334.
Sulfur:			
Elemental	224,118	288,424	United States 205,975.
Sulfur dioxide	5,931	6,974	West Germany 6,800.
Sulfuric acid	40,177	106,177	West Germany 89,588.
Talc, steatite, soapstone, and pyrophyllite	26,825	29,659	Australia 10,243; Norway 5,085.
Other nonmetals, n.e.s.:			
Crude	2	5	NA.
Slag, dross and similar waste, not metal bearing:			
From iron and steel manufacture	231,380	205,742	West Germany 64,125; France 44,222.
Slag and ash, n.e.s.	16,579	135,867	Netherlands 16,097.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	7,705	4,255	Trinidad and Tobago 1,083.
Carbon black	17,608	20,462	Netherlands 6,619; West Germany 6,143.
Coal and briquets:			
Anthracite and bituminous thousand tons	5,888	6,737	West Germany 3,800.
Briquets of anthracite and bituminous do	331	355	Netherlands 272.
Lignite and lignite briquets do	137	98	West Germany 94.
Coke and semicoke do	3,702	4,471	West Germany 3,398.
Gases, all kinds	36,727	NA	
Peat, including peat briquets and litter thousand tons	50	51	Netherlands 26.
Petroleum:			
Crude and partly refined do	17,588	23,394	Libya 4,242; Iran 8,960; Kuwait 8,218.
Refinery products:			
Gasoline, including natural do	581	609	Netherlands 318.
Kerosine and jet fuel do	50	158	Israel 71; Italy 35.
Distillate fuel oil do	2,666	1,999	Netherlands 512; Italy 413.
Residual fuel oil do	2,570	2,881	West Germany 618; U.S.S.R. 282.
Lubricants do	287	317	United States 81; Netherlands 78.
Mineral jelly and wax do	9	9	West Germany 4.
Other:			
Pitch coke	468	256	NA.
Petroleum coke thousand tons	91	109	United States 103.
Bitumen and other residues do	65	74	France 46; Netherlands 10.

NA Not available.

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COMMODITY REVIEW

Metals.—*Aluminum.*—Construction began of Alusuiss's new aluminum smelter at Amay near Liège. The plant is scheduled to go on stream at the end of 1971 or at the beginning of 1972, with an annual capacity of 84,000 tons. (A previous announcement indicated a capacity of 66,000 tons.) About 24 percent of the metal output will be delivered to the Sidal aluminum-product plant at Dulfel. Sidal will also be represented on the managing board of the new smelter. Reportedly, investments will total $700 million.[2]

Copper.—Imports of blister copper and anodes provided most of the raw copper processed by Belgium's refineries during 1969. The Olen plant operated at full capacity by Société Général Métallurgie de Hoboken, remained the principal producer of electrolytic copper in the country. The plant's annual electrolytic copper capacity was increased from 210,000 tons to 240,000 tons during 1969. Plans were readied for a further increase of capacity up to 270,000 tons. However, the date for completion of the second expansion phase was not announced. The construction of a new section for semicontinuous casting of copper plates continued, and the completion date was set for early 1970.

Iron and Steel.—Belgium's iron ore production of about 93,000 tons was insufficient to satisfy demand. The iron and steel industry operated almost entirely on imported iron ore during 1969.

Belgium increased steel production by 12 percent over that of 1968; the trend away from Thomas production and toward oxygen steel continued. The increase was entirely in oxygen-processed steel. Domestic steel consumption accounted for 25 percent of national output. The merger between Cockerill-Ougrée-Providence, Belgium's largest operating company, and Espérance-Longdoz was continuing according to a flexible schedule. The combined production of the two firms is slightly more than one-half the national total. The EEC has approved the merger. Investments by the steel industry were about $100 million, approximately $26 million more than in 1968 when investments were at a 10-year-low. Although one new blast furnace and one replacement blast furnace were under consideration the bulk of investment funds went into plant modernization.

Lead and Zinc.—The lead and zinc smelting-refining industry of Belgium operated at capacity during 1969, and Belgium produced about 110,543 tons of lead and 260,593 tons of zinc. All production was based on imported lead and zinc raw materials. According to preliminary figures, the principal suppliers of lead and zinc raw materials in 1969 were Canada, Congo (Kinshasa), Ireland, and Finland.

The Société des Mines et Fonderies de Zinc de la Vieille-Montagne, S.A., Compagnie des Métaux d'Overpelt-Lommel et de Corphalie, S.A., and Métallurgie Hoboken continued as the principal lead and zinc producers in the country. Modernization and improvement of existing facilities, rather than huge investments for new plants, were the general practices of the three principal lead and zinc producers of Belgium. At Hoboken new facilities for recovery of bismuth went on stream. However, details on capacity and other technical characteristics were not disclosed.

Other Nonferrous Metals.—Belgium produced cadmium, bismuth, germanium, selenium, and precious metals as byproducts of its smelting operations. In addition Belgium produced significant quantities of cobalt and radioactive elements and compounds from imported raw materials. Most of these products were exported.

Nonmetals. — *Cement.* — During 1969 cement producers operated 14 plants with 28 kilns. The largest producers were S.A. Cimenteies CRB with five plants and a total capacity of 2.2 million tons per year and Ciments d'Obourg S.A. with an annual capacity of 1.5 million tons.

Diamond, Precious Stones, and Gems.—Belgium remained a significant processor of imported raw diamond and other gems and precious stones. Foreign competition and the lack of replacements of aging cutters represented serious problems for the future of the industry.

Mineral Fuels.—Liquid fuels and natural gas remained the principal sources of energy in Belgium during 1969, and continued to displace domestic coal in the country's energy market.

Coal.—The regressing Belgian coal industry continued to face the same problems as in the few past years. During 1969,

[2] Where necessary, values have been converted from Belgium Francs (BF) to U.S. dollars at the rate of BFs50=US$1.00.

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the level of coal production was reduced by 11 percent, and the demand for coal fell approximately 5.5 percent. Both exports and imports were slightly below 1968. The industry however, registered some positive aspects by significantly reducing stocks of coal at mines, and by raising the miners' productivity index.

Six mines were shut down during the year, all in the southern fields. Three mines were closed in the Charleroi Basin, two in the Liège Basin and one in Center. Of the remaining 25 operating mines, five are located in Campine and 20 in the southern fields. The 25 mines in operation at the end of 1969 contrast sharply with the 75 mines operating at the beginning of the past decade.

Compared with the 1952 level, the number of operating mines in 1969 had been reduced about one-sixth and the number of workers to about one-fourth. Coal production at 13.2 million metric tons was less than one-half of the 1952 record, while the productivity index for all underground mines was more than double. The following tabulation shows the changes:

Year	No. of Mines	Production (thousand metric tons)	Employment (thousands, underground)	Productivity (metric tons per man-shift, underground)
1952	143	30,384	• 119,578	1,146
1960	75	22,465	77,333	1,388
1965	54	19,786	57,465	1,874
1968	31	14,807	37,114	2,232
1969	25	13,200	30,852	2,397

Imports of coals in 1969 declined only slightly from last year. The trade was marked by increases from non-EEC sources and a decided reduction from the EEC. Among the non-EEC suppliers, the United States maintained its leading position, Poland ranked second, and the U.S.S.R. followed third.

Apparently Belgium's coal consumption (20.3 million tons in 1969) declined by more than 1 million tons in 1969, chiefly as a result of the drop in the indigenous coal output. Imported coal accounted for 32.8 percent of the coal consumption compared with 31.6 percent in 1968. Coke plants were the principal coal users, with a consumption of 9,488 thousand tons of coal. Except for the coking sector, all other consumer groups used less coal in 1969 than in 1968.

Petroleum and Natural Gas.—Belgium remained a large crude-oil processing country during 1969. The industry is completely based on imported crude oil; it has no domestic output and there has been only limited exploration for liquid hydrocarbons. The growth of Belgium's petroleum industry continued during 1969, although there were no new refineries commissioned. The expansion of two refineries at Antwerp, that of International Oil by 2.7 million tons and Rafinerie Belge by 2 million tons, increased the total refinery capacity to 28 million tons per year. In addition, the Belgian-U.S.S.R. enterprise, Nafta-B, a new company in Antwerp, was building a tank farm with a capacity of 28 million cubic feet on a 68-acre site intended for refined products from the U.S.S.R.

The Chevron Company has received Government approval for a 5-million-ton-per-year refinery at Feluy near Nivelles. Crude oil for this new refinery will be delivered through the Rotterdam-Antwerp pipeline, in which Chevron has a 16-percent interest, and through an extension Chevron will build at its plant site near Feluy. Reportedly it will also build product lines to customers in southern Belgium as well as to Brussels and Antwerp. The refinery is scheduled to go on stream in mid-1971.

The conversion to imported natural gas from the Netherlands continued during 1969 in Belgium. About 7,000 million cubic meters of natural gas was delivered, and at yearend 1969, natural gas had reached about 50 percent of Belgium's 1.5 million gas consumers.

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LUXEMBOURG

The iron and steel industry of Luxembourg continued as the only segment of the country's mineral industry that was of significance by European standards. Production of other mineral commodities, mostly quarry products and manufactured fertilizers, were of local importance only.

Although official trade data were reported together with that of Belgium, it is known that imports of iron ore, nonferrous metals, and fuels were essential to supply Luxembourg's mineral-processing industries. Roughly about 70 percent by value of the country's total exports can be attributed to export of iron and steel products.

Table 4.—Luxembourg: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969 •
METALS			
Iron ore and concentrate	6,304	r 6,393	6,400
Pig iron (including blast furnace ferroalloys)	3,963	r 4,308	4,872
Steel ingots and castings	4,481	r 4,834	5,500
Semimanufactures	3,531	3,771	3,800
NONMETALS			
Cement, hydraulic	r 186	191	190
Gypsum and anhydrite, crude	11	9	
Fertilizers, manufactured: Phosphatic:			
Thomas slag, gross weight	• 750	730	750
Other (P_2O_5 content)	120	110	120
Quartz, quartzite, and glass sand—thousand cubic meters	27	25	27
Stone, sand and gravel, n.e.s.:			
Molding sand	28	24	24
Stone:			
Building stone:			
Rough-cut—thousand cubic meters	• 25	20	20
Facing—thousand square meters	• 6	5	4
Cut stone, crude—thousand cubic meters	1	1	1
Crushed rock—do	• 160	150	160
Dolomite	171	170	180
Limestone	30	28	20
Paving blocks—thousand pieces	• 35	33	30
MINERAL FUELS AND RELATED MATERIALS			
Coke, gas plant	• 10	10	10
Manufactured gas—million cubic meters	25	24	23

• Estimate. r Revised.

COMMODITY REVIEW

Metals.—*Iron and Steel.*—The iron and steel industry, employing about 47 percent of all wage earners, remained by far the most important segment of the country's minerals industry. The small Grand Duchy of Luxembourg produced inadequate quantities of iron ore to cover the demand. Iron ore production totaled about 6.4 million tons, and imports, mostly from France, were essential for the operation of the steel industry. Reserves of iron ore amounted to about 200 million tons, and the deposits covered an area equal to approximately 1.4 percent of the country's total surface. The metal content of ore was low and varied between 20 and 30 percent, averaging 28 percent. Nine open pit and four underground mines were in operation.

Steel production totaled 5.5 million tons. Aciéries Réunies de Burbach-Eich-Dudelange, S.A., Luxembourg (ARBED) was the largest iron and steel producer in the country. The increase in production resulted mostly from new facilities. In broad outline the new investments will provide for concentration of pig iron production at the Esch-Belval plant and will include construction of two blast furnaces and an ore crushing and processing plant, as well as a new LD-AC converter for the Differdange Division and the expansion of the wire-rod facilities in the various ARBED divisions.

S.A. Minière et Métallurgie de Rodange, Luxembourg's other steel producer and a specialist in wire rods, completed a rolling mill in October and has announced plans for a new blooming mill modernization program.

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The Mineral Industry of Bolivia

By Frank E. Noe [1]

The political stability and economic progress which had existed for the past several years came to an abrupt end in 1969 as the result of several events which precluded normal, healthy development of private enterprise, particularly in the field of mineral resources, in Bolivia. The climate for investment in the mineral industries, which had been stimulated by President René Barrientos, suffered a severe setback in April when the President was killed in a helicopter crash. Political developments subsequently culminated in a takeover of the Government by a group of Army officers with General Alfredo Ovando Candia as President of the military coup. The military Government issued a manifesto outlining its economic program as being a system neither capitalistic nor socialistic but rather nationalistic and revolutionary. Principal economic objectives listed by the new regime were to reassert the country's sovereignty over natural resources, expand the mining industry, protect national capital, control imports, and reorganize the system of the exports of metals and minerals. Simultaneously with the declaration of its economic precepts, the military government annulled the Petroleum Code of 1956. Although General Ovando announced on October 11, 1969, that the Bolivian Gulf Oil Co. (BOGOC) would not be nationalized, the revolutionary government, on October 17, nationalized BOGOC, an American company with heavy investments in the Bolivian oil business. This created a tremendous anxiety among private enterprises in Bolivia, and clarification of the future policy of the new Government was still awaited at year-end.

The following is a list of Supreme Decrees and Supreme Resolutions proclaimed during 1969 which are of particular significance to the mineral industry:

D. S. Number 08635, January 29, 1969: Authorizes the Banco Minero de Bolivia (BAMIN) to buy and sell gold as well as silver and platinum. It authorizes the Central Bank, through a revolving credit, to lend BAMIN capital required to buy Bolivian gold production. All producers of above metals must sell production to BAMIN and will be paid world market prices (London Metal Exchange) less transportation, insurance, refining, and commercialization costs. Producers of complex minerals which also contain gold, silver, and platinum may continue to export their product as before.

D. S. Number 08676, February 26, 1969: Lifts fiscal reserve status of 487,088 hectares in zone 1 and gives the potential oil-gas land reserve to Yacimientos Petrolíferos Fiscales Bolivianos (YPFB).

D. S. Number 08871, July 31, 1969: All the potential oil- or gas-bearing ground is now considered a Government reserve area except that land under concession to YPFB or private oil companies.

D. S. Number 08872, July 31, 1969: Requires those companies that supply specialized technical services and who wish to be considered as contractors in Bolivia to be accredited by the Ministry of Mines and Petroleum. They must hire a legal representative with an office in La Paz and must deposit a guarantee of $10,000 to the order of the Dirección General de Petróleos in the Central Bank. No foreign company is allowed to supply those services that can be carried out by national contracting companies. Those contracting companies with authorization to work in Bolivia must have at least 85 percent Bolivian nationals on their payroll.

D. S. Number 08873, July 31, 1969: Turns over to YPFB all Government re-

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serve areas where potential gas or oil deposits may be found.

D. S. Number 08936, September 26, 1969: Annuls the Petroleum Code and its Regulations decreed respectively on October 26, 1955, and January 24, 1956.

D. S. Number 08950, October 6, 1969: Establishes that all tin-ore and tin-concentrate producers in Bolivia must offer to sell to the Empresa Nacional de Fundiciones (ENAF), starting November 1, 1969, the quantity and quality of the above tin products that ENAF estimates the producer can supply.

D. S. Number 08956, October 17, 1969: Decrees the nationalization of the Bolivian Gulf Oil Co. (BOGOC).

D. S. Number 08959, October 25, 1969: Obligates the surrender to the Central Bank of Bolivia of 100 percent of the foreign exchange arising from exports by the public and private sectors at the rate of exchange of $bl1.875 per dollar, except for expenditures associated with sales. All foreign currency needed for import of machinery, freights, etc., is to be rebought at the Bank's selling rate of $bl2.132 per dollar. Except for YPFB, entities of the public sector and the enterprises subordinate to them will pay 20 percent of their net profits to the State. YPFB will pay 19 percent of gross production value in addition to the departmental royalties of 11 percent of gross production value. As of October 25 up to December 31, 1970, the private mining sector will set up as a time deposit, with a minimum period of 1 year, in Bolivian owned national banks at the time of obligatory surrender of foreign exchange, the following percentages on the gross value of their exports or sales: small miners—1.5 percent; medium miners—2 percent; other mining firms—3 percent. In addition, all private firms will set up in national banks, in the form of time deposits for a minimum of 1 year, all the dividends or sharing in profits declared in favor of the stockholders or partners, after the payment of taxes on total income.

D. S. Number 09009, November 27, 1969: Declares as a national reserve all mineral deposits in the Provinces of Mamoré and Itenez, Department of Beni.

D. S. Number 09016, November 27, 1969: Declares that the gold-mining concessions of BOL-INCA Mining Corp. are cancelled and reverted to the State.

D. S. Number 09028, December 10, 1969: Gives the Banco Minero the total Bolivian mineral export monopoly and annuls Article 201 of the Mining Code. However, if mineral producers can show BAMIN by their contracts that they can obtain better conditions or financing terms than BAMIN offers, they are free to sell their products to others. They must still register their contracts both with BAMIN and at the Central Bank. All such producers, including Corporación Minera de Bolivia (COMIBOL), must pay BAMIN commissions on the total mineral export value ranging from 0.25 percent on zinc concentrates to 1.50 percent on high-grade tin, wolfram, copper, antimony, silver, and mercury.

The contribution of the mineral industry to the gross domestic product of Bolivia decreased from 17 percent in 1968 to 15 percent in 1969; however, the industry accounted for 95.5 percent of the total value of Bolivia's f.o.b. exports.

PRODUCTION

Except at the operations of COMIBOL, actual production is not measured. For the small and medium mines, production is measured by exports with the exception that free gold and insignificant silver production from alluvial sources is not exported regularly but is purchased by the Central Bank through BAMIN. During the year, production gains were shown for most metals and nonmetals except for bismuth, gold, and asbestos. Zinc production increased 133 percent, and lead gained almost 14 percent as a result of the initiation of operations at the country's largest zinc mine. Production of natural gas dropped an estimated 13 percent but there was little change in the production of crude petroleum or refinery products.

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Table 1.—Bolivia: Approximate production of mineral commodities
(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
METALS [1]				
Antimony:				
Mine output, metal content [2]		11,276	11,117	18,187
Metal [2]		8	r 47	28
Beryllium, beryl concentrate [2]	gross weight	------	1	------
Bismuth:				
Mine output, metal content		502	r 611	607
Metal		------	------	3
Copper:				
Mine output, metal content		6,087	r 7,131	7,983
Metal		------	------	18
Gold, mine output, metal content	troy ounces	55,069	68,266	e 51,000
Iron ore		------	------	1,765
Lead:				
Mine output, metal content		r 20,242	r 21,684	24,703
Metal, including alloys		237	NA	22
Mercury [2]	76-pound flasks	100	134	68
Silver, mine output, metal content	thousand troy ounces	4,515	5,180	6,018
Tin:				
Mine output, metal content	long tons	26,890	r 28,945	29,415
Metal, including alloys	do.	800	------	47
Tungsten, mine output, metal content		r 1,546	r 1,771	1,841
Zinc, mine output, metal content		16,754	r 11,223	26,195
NONMETALS				
Asbestos [2]		4	1	------
Cement	thousand tons	62	71	80
Gypsum, crude [2]		1,100	1,600	8,613
Salt [2]		4,445	NA	NA
Sulfur, elemental [2]		r 50,307	35,429	36,219
MINERAL FUELS AND RELATED MATERIALS				
Gas, natural, gross production	million cubic feet	30,465	r 32,683	e 28,409
Natural gas liquids:				
Natural gasoline	42-gallon barrels	65,661	NA	NA
Liquefied petroleum gas	do.	3,142	NA	NA
Petroleum:				
Crude oil	thousand 42-gallon barrels	14,527	r 14,974	14,759
Refinery products:				
Gasoline, motor	do.	1,507	1,652	1,846
Kerosine and jet fuel	do.	679	740	808
Distillate fuel oil	do.	752	624	612
Residual fuel oil	do.	792	1,020	958
Liquefied petroleum gas	do.	8	21	27

e Estimate. p Preliminary. r Revised. NA Not available.
[1] COMIBOL production plus exports by small and medium mines and smelters unless otherwise noted.
[2] Exports by small and medium mines.

TRADE

Preliminary figures indicated an export value for minerals of $140 million [2] (f.o.b.) and $25.3 million for petroleum, an increase over 1968 figures of $22.2 million and $200,000, respectively. Tin continued to be the principal export although its share of the total export market dropped from 53 percent in 1968 to 49 percent in 1969. Although the quantity of metallic mineral exports increased slightly over 23,000 tons, zinc alone accounted for almost 15,000 of this difference. On a value basis, however, zinc exports increased only $4.84 million while tin and antimony increased respectively $9.9 million and $4.9 million. Data pertaining to Bolivian imports on a commodity basis are not yet available for 1968.

The relation of mineral trade to total trade for 1967–1969 is tabulated below:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports (f.o.b.):		
1967	146	153
1968	143	150
1969	165	173
Imports (c.i.f.):		
1967	15	151
1968	NA	153
1969	NA	e 167

e Estimate. NA Not available.

[2] When necessary, values have been converted from Bolivian dollars (B$) to U.S. dollars at the rate of $B11.885=US$1.00.

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Table 2.—Bolivia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Antimony:		
In ore and concentrate	11,468	11,070
Metal, including alloys, all forms	8	47
Beryl, kilograms	------	1,309
Bismuth, in ore and concentrate	531	575
Copper, in ore and concentrate	6,342	6,930
Gold, troy ounces	1,157	745
Lead:		
In ore and concentrate	19,987	22,826
Metal, including alloys, all forms	351	
Mercury, 76-pound flasks	140	134
Silver, in ore and concentrate, thousand troy ounces	4,518	5,180
Tin:		
In ore and concentrate, long tons	25,941	28,945
Metal, including alloys, do	1,038	------
Tungsten, in ore and concentrate	1,547	1,811
Zinc, in ore and concentrate	16,697	11,785
NONMETALS		
Asbestos	4	1
Gypsum	1,390	1,600
Salt	4,784	------
Sulfur, elemental	50,308	35,429
MINERAL FUELS AND RELATED MATERIALS		
Gas, hydrocarbon, million cubic feet	303	------
Petroleum, crude, thousand 42-gallon barrels	10,521	10,329

COMMODITY REVIEW

METALS

Antimony.—The Empresa Minera Unificada, S.A. (EMUSA), continued to be the most important antimony producer in Latin America. The company exported slightly over 5,000 metric tons during the year. Most of the company production comes from two mines, the Chilcobija mine near Tupiza, and the Caracota mine near Potosí. Both mines have new mills which can treat between 100 and 140 metric tons each per day. During the year, dump material from previous operations was combined with mine output in order to increase recovery. Other important antimony producers are Empresa Minera San Juan, Empresa Minera Bernal Brothers, Churquini Enterprises, and Compañía Minera del Sur. Approximately 20 other medium mining companies produced an annual average of 61 metric tons each.

Representatives of Japanese companies entered into discussions with medium-sized mining companies for the construction of an antimony smelter near Tupiza. ENAF arranged for the visit of three technicians from the Czechoslovakian Skoda Co. to carry on a feasibility study for the construction of an antimony smelter near Oruro.

Bismuth.—In spite of opposition by ENAF, which claimed that it is the only entity authorized to smelt mineral concentrates in Bolivia, COMIBOL was authorized by the Cabinet to establish a bismuth smelter in Telemayu. A contract was signed with the Belgian firm Poudreries Réunies de Belgique for the construction of a smelter with a capacity to produce about 70 metric tons of bismuth per month. Construction of the $1.1 million smelter began in October and was scheduled for completion and operation by March of 1971.

Gold.—South American Placers, Inc. (SAPI), continued to be the principal producer of gold in Bolivia. During the year, SAPI produced 973,190 grams of fine gold and 34,882 grams of silver. All of SAPI's production is sold to the Central Bank through BAMIN at the London Metal Exchange price minus 17 percent taxes on gross production and other charges by BAMIN. SAPI has about 2 years of dredging operations before it runs out of reserves.

The BOL-INCA Mining Corp. lost concessions to 77,772 acres of gold placer ground along the Mapiri, Kaka, and Beni Rivers for a linear distance of 162 miles when, in Supreme Decree Number 09016, the Government cancelled BOL-INCA's concessions and reverted the land to the State. Initial concessions were obtained by the company in the period 1932–37, but

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there is no record of any gold production by the company from that time to the present. The last company to explore BOL-INCA's concessions was Tidewater Oil Co. in 1964–65 when Tidewater drilled 200 exploratory holes in the Mapiri, Kaka, and Alto Beni Rivers with negative results.

There are reportedly about 40 to 50 active cooperatives located along the Tipuani River. The Tipuani gold cooperatives in 1969 sold 17,860 troy ounces of fine gold to BAMIN.

Tin.—Construction continued throughout the year on the $9.3 million tin smelter being erected at Vinto near Oruro for the National Smelting Co. At yearend it was estimated that the smelter would be ready for operation about September of 1970. During the year, two laws were decreed specifically to assist the National Smelting Co. both financially and materially. D. S. Number 08916 of September 13 exempted ENAF from payment of export taxes on its future metallic sales until it had capitalized itself to the amount of $4 million. D. S. Number 08950 of October 6 decreed that all tin producers—small, medium, and nationalized mines—would have to offer their production of tin concentrates to ENAF which will select the quantity and quality that it requires. Under the decree, ENAF is empowered to inspect the individual mining operations to determine the quality and quantity of tin concentrates which can be produced. In addition, Bolivian customs offices are not to permit the export of tin concentrates without authorization from the Ministry of Mines and Petroleum.

COMIBOL continued to carry on volatilization studies at the old Pero and Metabol smelters. With very low-grade tin concentrates as a raw material, a volatilization product (flue dust) was produced. Approximately 572 tons of this product assaying 49.22 percent tin were exported and are included in the export figures in table 4.

The total unit cost to COMIBOL to place one pound of tin, mined and milled by its own facilities, in the world market decreased from $1.35 in 1968 to $1.34 in 1969. COMIBOL's purchases of tin in concentrate form decreased from 2,542 tons of fine metal content in 1968 to 2,433 tons in 1969. The price COMIBOL paid per pound of fine tin content was $0.95, the same as in 1968, but the total cost to place one pound of purchased tin in the world market was reported at $1.37.

The Empresa Minera ESTALSA, owned by W. R. Grace & Co., Chase-Manhattan Bank, Lockheed Aircraft Corp., and United States Steel Corp., was the only tin-dredging operation in Bolivia in 1969 and was the major private tin producer in the country. The dredge and two washing plants supplied by slushers had an effective daily production capacity of 10,300 cubic yards and worked approximately 270 days during the year. The company produced during its first full year of operation 1,802 metric tons of fine tin in concentrates which averaged about 42 percent tin. The dredge operated near the village of Avicaya which is approximately 75 kilometers south-southeast of Oruro.

In 1965 International Metals Processing Corp. (IMPC) obtained a lease from COMIBOL to work the Kenko tin tailings deposit from the Catavi mill. IMPC has developed a flotation process for recovering tin from the Kenko tailings but, although the flotation mill was completed 2 years ago, a satisfactory system for feeding the mill has not been developed. The company has two small suction dredges, but the consolidated slimes and sands must be broken up before suction is possible. The dredges are equipped with rotary blades to break up the ground, but because of the many years the tailings have been in place, the slimes have acted as a cementing agent on the coarser sand grains, thus making certain layers extremely hard. The resulting abrasion of the cutting blades plus the very high acidity of the tailings water have created a problem which has not as yet been successfully solved. The company exported during the year only 17.3 metric tons of tin in concentrates containing about 20 percent tin. IMPC employs about 40 permanent personnel and has invested an estimated $3.0 million in Bolivia.

Trans-American Resources, Inc., a subsidiary of Shattuck-Denn Mining Co., has been developing the Kellguani tin mine, just north of La Paz on the southern flank of Chalcataya Mountain. The company operated a small mill, about 60 metric tons input capacity, but this was not profitable at that small mining scale. Production by small contractors is continuing. During the year the company produced 75 metric tons of fine tin and exported about 65 metric tons in high-grade tin concentrates. The

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mine is unique in Bolivia because it is an interbedded quartzite and shale deposit in which most of the tin mineralization occurs in fractures but only in the quartzite. The shale, which is almost slate, does not carry tin. The deposit is of low grade, about 0.60 percent tin, but has an enormous volume of potential reserves. There are 13 known quartzite beds, ranging in thickness from 3 to over 30 meters, which dip about 25 degrees to the south making it ideal for large-volume production using a long-wall retreat mining method. The mine could be a large tin producer if worked on a scale of about 2,000 metric tons per day and if thoroughly mechanized. Trans-American, however, lacks sufficient capital for the investment this mine requires and has given an option to the Scurry Rainbow Oil Co. which is reported to be checking reserves and metallurgical treatment.

Table 3.—Bolivia: Exports of tin by grades, groups, and companies, 1969

(Kilos of contained tin)

Grade	COMIBOL	Medium mines	BAMIN (medium)	BAMIN (small)	Other	Total
0 to 10	101,468	79,400	-------	8,696	-------	189,564
10 to 15	69,952	169,105	-------	105,785	[1] 11,408	356,250
15 to 20	639,325	519,634	24,210	869,109	-------	2,052,278
20 to 25	954,848	1,342,982	126,326	710,705	[1] 5,899	3,140,760
25 to 30	680,481	505,139	-------	270,113	-------	1,455,733
30 to 35	945,633	217,708	13,682	146,643	[2] 581	1,324,247
35 to 40	2,370,707	1,384,491	7,645	46,647	-------	3,809,490
40 to 45	3,042,507	928,274	16,715	315,041	[2] 9,131	4,311,668
45 to 50	4,204,708	602,974	8,691	662,876	[2] 3,944	5,483,193
50 to 55	1,247,180	389,347	-------	552,739	[2] 5,299	2,194,565
55 to 60	4,572,090	141,949	-------	401,575	-------	5,115,614
60 to 65	48,013	273,732	-------	185,401	-------	507,146
65 to 70	-------	-------	-------	13,030	-------	13,030
Over 99	-------	-------	-------	-------	[3] 7,976	7,976
Total	18,876,912	6,554,735	197,269	4,288,360	44,238	29,961,514

[1] International Metal Processing Co.
[2] Hormet Smelter.
[3] Empresa Nacional de Fundiciones (ENAF).

Source: Ministerio de Minas y Petróleos.

Table 4.—Bolivia: Exports of tin by groups

(Long tons of contained tin)

Group	1967	1968	1969 p
Tin in concentrates:			
Corporación Minera de Bolivia (COMIBOL)	17,377	18,520	18,312
Medium-size mines	5,328	6,674	6,662
Banco Minero	3,234	3,751	4,221
Smelter products:			
Refined metal and solder	1,038	------	27
Volatilization products	------	------	267
Total	26,977	28,945	29,489

p Preliminary.

Table 3 shows a breakdown of tin concentrate exports by grades and groups.

Zinc.—In February 1967, the Matilde Mine Corp., a 50-50 partnership between United States Steel and Philipp Brothers Corp., was granted congressional approval of its lease and production contract with the Government of Bolivia. Two years and almost $13 million later the largest zinc producer in Bolivia went into operation. The production goal is 330,000 metric tons of ore annually. In 1969 production was 31,057 metric tons of zinc concentrate averaging about 55 percent zinc and 4,026 metric tons of lead concentrate of 60.5 percent lead. The mining method used is overhead cut and fill with the fill being pumped to the stopes directly from the mill. The concentrate travels by a 7 mile pipeline to Chaguaya on Lake Titicaca, across the lake by ferry, and by rail from Puno to Matarani, the Peruvian shipping port. Eventually the company will produce about 100,000 metric tons of zinc concentrates assaying 56 percent zinc and approximately 6,000 metric tons of lead concentrates assaying about 55 percent lead.

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NONMETALS

Cement.—The Sociedad Boliviana de Cemento completed expansion of its plant at Viacha. The plant rated at 200 tons per day was able to produce only 25,000 tons following its expansion as a severe storm knocked down the chimneys in October and 3 months' production was lost.

The Compañía Boliviana de Cemento began construction of a cement plant about 40 kilometers from the city of Cochabamba. It was estimated that the investment, made by a local cooperative, would be more than $5 million. The plant, equipped with Italian machinery, would have a capacity of approximately 100,000 tons of cement annually.

Sulfur.—Decree Law Number 472 of January 24, 1969, permits private national or foreign capital to invest in development and mining of sulfur concessions owned by the Caja de Pensiones Militares (CPM) inside the 50-kilometer border strip in western Bolivia with the proviso that the majority of the joint venture stock or greater participation be held by the CPM. It was reported that the Scurry Rainbow Oil Co. of Canada had a contract with CPM and had done exploratory drilling, but due to the low price of sulfur on the west coast, mining operations were postponed pending improvement of the sulfur market.

MINERAL FUELS

Petroleum and Natural Gas.—On October 17, by Supreme Decree Number 08956, General Alfredo Ovando nationalized BOGOC. Within a few days, crude oil storage facilities were filled and all oil and gaswells were shut down with the exception of those wells required to meet YPFB crude oil export commitments to Argentina. The Gulf Oil Corp., which marketed all exports from BOGOC production, refused to move crude from the storage tanks on the Pacific coast until some agreement had been reached as to compensation for its expropriated subsidiary, BOGOC. At about the same time, work on the natural gas pipeline from Boliva to Argentina was halted as supplies and money were exhausted. It has been estimated that this pipeline would have earned Bolivia about $15 million per year beginning in July or August of 1970.

As reported in the 1968 Minerals Yearbook, the Bolivian Government, represented by BOGOC and YPFB, signed a sales agreement with Gas del Estado to deliver to Argentina over 1 trillion cubic feet of gas in a 20-year period. The Bolivian Government approved the formation by YPFB and BOGOC of a Delaware corporation called Yacibol-BOGOC Transportadores (YABOG). This corporation was to serve as an autonomous transportation concessionaire charged with the construction of a pipeline and the transport of gas at cost from the Bolivian fields to the Argentine border. YABOG was then able to borrow on the credit of its sponsors the funds required for the construction of the pipeline. The World Bank lent the enterprise $23,250,000 which was guaranteed by the Government of Bolivia and jointly and severally by YABOG's two sponsors. An additional loan for the same amount was obtained from the New York State Common Retirement Fund on the basis of a guarantee by the Gulf Oil Corp. After international competitive bidding, contracts were let for the main supply of pipe with a German firm which had subcontracted a sizable portion to an Argentine manufacturer, and with a United States firm, Williams Brothers, for the pipelaying and related construction work. The project got under way almost immediately and entailed the construction of a natural gas transmission system, comprising a 329-mile high-pressure trunkline, 24 inches in diameter, from Santa Cruz in Bolivia to Yacuiba on the Argentine border and about 100 miles of lateral lines to connect several gasfields with the trunkline. Early in November, Williams Brothers was forced to halt construction due to lack of pipe and other supplies. Immediately following the expropriation of BOGOC, Gulf withdrew its guarantees of credit to the New York Common Retirement Fund, to the German supplier of pipe, and to other suppliers. The Retirement Fund refused to make further disbursements to YABOG, and deliveries of pipe were stopped by the supplier. No disbursement had been made of the World Bank loan, but since this loan was guaranteed jointly and severally by BOGOC and YPFB with Gulf Oil guaranteeing BOGOC's compliance, the expropriation nullified the bases on which the loan was established, thus requiring the renegotiation of any future loan to Bolivia for the project.

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Crude oil production for Bolivia in 1969 was only slightly under 1968 production. Output from the BOGOC fields dropped following nationalization. It was estimated that BOGOC, until its nationalization on October 17, produced 9.355 million barrels, and the total amount of oil produced from the former BOGOC fields was reportedly 10,605,632 barrels. Also as a consequence of nationalization, BOGOC exported only 6,846,072 barrels to California in 1969, as compared with 8,176,359 barrels in 1968.

Caranda was the only former BOGOC field still producing at yearend, and it was estimated that output had decreased by December 1969 to an average of 13,312 barrels per day, whereas daily average production in 1968 had been 27,700 barrels. The Colpa and Rio Grande fields had to be closed down for lack of a gas cleaning plant at Colpa and for an addition to a gas recycling plant at Rio Grande. These plants were needed in order to economically produce and recover the gas, condensate, and oil present in those fields.

Oil production by YPFB in 1969 increased 29.2 percent over that of 1968, largely as the result of a fourfold increase in output from the Monteagudo field. YPFB's production of 4,153,660 barrels was not sufficient, however, to cover the quantity of oil processed in YPFB refineries which was reported as 4,433,308 barrels. YPFB increased its oil exports to Argentina from 2,152,884 barrels in 1968 to 3,221,772 barrels in 1969.

During the year and until nationalization, BOGOC drilled 18 new wells with a total footage of approximately 168,000. Only two of these were exploration wells. Preliminary information indicates that YPFB drilled 40 wells having a total footage of 255,154. In the Monteagudo field alone, 13 development and six exploration wells were completed.

YPFB refineries processed 12,146 barrels per day, a consumption increase of only 4.7 percent over 1968 in contrast to an average annual increase from 1963 through 1968 of 9.6 percent. The principal products of the refineries were white gasoline, fuel oil, kerosine, and diesel oil, which accounted for approximately 94 percent of refinery production.

As of December 31, 1969, Bolivia had an estimated total gas reserve of 2,900 billion cubic feet (90 percent from former BOGOC fields) and oil and condensate reserves of approximately 193 million barrels. It is interesting to note that although a great deal has been written about the contribution of petroleum, and especially crude oil exports, to the national economy, prospective gas sales will be much more important financially to Bolivia. The existing contract with Argentina calls for delivery of a total of 1,115 billion cubic feet of gas in 20 years for an estimated $300,971,700. At the end of the contract, Bolivia would still have 1,785 billion cubic feet left, or more than enough for another similar 20-year contract with Argentina. On the other hand, given an 8-percent increase annually in oil consumption in the next 18 years, the present oil-condensate reserve will have dwindled to about 13 million barrels without having sold a barrel outside of Bolivia. Alternatively, if Bolivia continues to export at its 1969 rate of approximately 10 million barrels per year and also satisfies her internal consumption,

Table 5.—Bolivia: Crude petroleum by company and field

(Thousand 42-gallon barrels)

Company and field	1968	1969 p
Yacimientos Petroliferos Fiscales Bolivianos:		
Camiri	1,496	1,385
Tatarenda	884	699
Monteagudo	438	1,748
El Toro	116	112
Bermejo	95	127
Camatindi	42	88
Buena Vista	16	--
El Tigre	16	20
Guayrui	12	25
Itapirenda	9	--
San Alberto	4	--
Total	3,128	4,154
Bolivian Gulf Oil Co.:		
Caranda-Colpa-Rio Grande	r11,846	10,605
Grand total	r14,974	14,759

p Preliminary. r Revised.

Table 6.—Bolivia: Consumption [1] of petroleum refinery products

(Thousand 42-gallon barrels)

Product	1968	1969
Gasoline, aviation	[2] 132	105
Gasoline, motor	1,505	1,633
Kerosine	652	705
Diesel oil	439	505
Fuel oil	759	656
Lubricants	38	51
LPG	20	43

[1] Figures refer to actual civilian and military consumption through sales to consumer, and including YPFB consumption.
[2] Imports.

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the reserves left at the end of the next 10 years would be only 23 million barrels, enough then for 2 years of internal consumption. Therefore, unless more oil discoveries are made in the near future, it is questionable whether Bolivia will continue to export oil at the present volume.

Petrochemicals.—Bolivia, as a member of the subregional Andean group of countries, was allocated the manufacture of two basic resins for plastic manufacture and two basic insecticide-pesticide products. Stanford Research Institute and Syracuse University were preparing at yearend a feasibility study for YPFB on the manufacture and marketing of the following products: SBR resin, ABS resins, styrene, Acrylonitrile, phenol, acetone, and polystyrene.

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The Mineral Industry of Brazil

By Burton E. Ashley [1] and Gordon W. Koelling [2]

Shortages and the prospect of shortages of mineral products encouraged expansion and new construction for Brazil's active mineral industry.

Cement was in short supply, and future needs for iron ore, iron and steel, and aluminum gave the incentive for expansion programs. By 1971, a minimum of 85,000 tons per year of domestic aluminum should be available, and output gains in iron ore and iron and steel should be substantial.

The world's first pelletizing plant for manganese ore was planned for Amapá; apatite use for fertilizers increased, and a source of potassium for fertilizer was being studied for development in Sergipe.

In order to coordinate expansion efforts to needs, two Government-controlled organizations were formed to assist this function. The Conselho Consultivo da Siderúrgica (CONSIDER) was formed as an interministerial body for the purpose of formulating and coordinating national steel policy; in addition, CONSIDER would establish guidelines for granting incentives and priorities for building or expanding plants. CONSIDER could authorize exemptions from duty for imports of equipment and for deduction of depreciation quotas for certain companies; it could also execute or contract studies required for planning purposes. CONSIDER was to be concerned with steel companies controlled by the Government and had no power over privately held steel companies. However, if private companies intended to borrow from Government institutions for building or expansion, they would need to have their plans approved by CONSIDER.

Late in 1969, Decree Law 764 of August 15, 1969, created Cia. de Pesquisas Recursos Minerais (CPRM). The authorized paid capital of CPRM is to be represented by 100 million shares with a nominal value of NCr$1 each (about 24 U.S. cents). Sixty percent of the shares were to be common stock and the remainder preferred stock. The Government will at all times hold a minimum of 51 percent of the shares with voting right. The remainder of the shares may be held by any legal entity, private, public, or State.

The objectives of CPRM are to: (1) Stimulate the discovery and intensify the utilization of mineral and water resources of Brazil, (2) encourage private initiative in prospecting and utilizing such resources, (3) assist private initiative in prospecting, and (4) give administrative and technical support to the entities under the direct administration of the Ministry of Mines and Energy.

Petroleum, other liquid hydrocarbons, and rare gases are excluded from CPRM's efforts in mineral and water resource development.

Certain import duties were suspended on some fertilizers, solid fuels, and cryolite and allied substances. The cement import quota was raised to 2 million tons, and the ad valorem duty rate was lowered from 37 to 15 percent on the quota tonnage. For cement, provisions were made to assure that imports would not decrease sales of cement produced in Brazil.

For sodium hydroxide, import duty was waived for importers proving purchases of the domestic product in proportion of 100 percent of the quantity to be imported. Where imports were necessary because of internal transportation problems of the national product, the ad valorem duty was reduced to 15 percent. Import duty was also waived for a quota of 60,000 tons of steel rods and billets meeting stated specifications.

The maximum area to be allowed under

[1] Physical scientist, Bureau of Mines, Washington, D.C.
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prospecting rights was increased from 1,000 hectares to 10,000 hectares. The new allowance applied to areas of lesser accessibility for the purpose of more effective examination where large expenditures were involved.

PRODUCTION

Mineral output in 1969 recorded gains in many commodities, with iron ore outstanding with a rise of more than 30 percent. Table 1 shows mineral production for the years 1967 through 1969.

Table 1.—Brazil: Production of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Aluminum:			
Bauxite, gross weight	302,853	313,784	348,000
Alumina	86,943	e 83,000	87,000
Metal, primary	r 37,790	e 41,470	e 48,200
Antimony, metal [2]	59	102	104
Arsenic, white	222	312	300
Beryllium, beryl concentrate, gross weight [3]	1,310	2,078	NA
Chromium, chromite, gross weight e	r 15,025	17,032	15,766
Columbium and tantalum, ore and concentrate, gross weight:			
Columbite [3]	102	63	NA
Tantalite [3]	205	272	NA
Pyrochlore	4,626	4,999	8,663
Copper:			
Mine output, metal content e	2,150	2,700	NA
Metal, blister e [4]	3,500	3,500	3,500
Gold, metal [5] thousand troy ounces	r 186	177	194
Iron and steel:			
Iron ore and concentrate thousand tons	22,298	25,123	e 33,000
Pig iron, excluding ferroalloys do	r 3,069	3,369	3,704
Ferroalloys:			
Ferromanganese	31,308	e 12,870	12,796
Ferrosilicon	15,625	e 6,897	8,350
Ferrochromium	1,665	r 3,642	NA
Ferrocolumbium	528	1,144	2,128
Ferronickel	4,098	4,119	NA
Silicomanganese	4,726	e 4,697	5,005
Other	118	NA	NA
Steel, excluding castings thousand tons	r 3,734	4,453	4,905
Steel, semimanufactures do	2,848	3,425	3,903
Lead:			
Mine output, metal content	23,422	27,018	27,593
Metal, primary	17,234	16,167	18,720
Manganese, ore and concentrate (marketable), gross weight thousand tons	r 1,202	1,680	1,691
Nickel:			
Mine output, metal content	1,224	1,240	NA
Ferroalloy, nickel content	1,071	1,076	NA
Rare-earth metals, monazite concentrate, gross weight	1,079	1,691	1,999
Silver, metal thousand troy ounces	r 479	464	360
Tin:			
Mine output, metal content e long tons	1,600	2,240	2,560
Metal, primary do	1,415	1,251	1,191
Titanium:			
Ilmenite concentrate, gross weight	14,967	17,881	20,283
Rutile concentrate, gross weight	r 291	114	9
Tungsten, mine output, metal (W) content e	289	434	460
Zinc, metal	1,792	3,507	NA
Zirconium, concentrate, gross weight:			
Zircon	2,162	2,812	3,129
Other	e 500	485	385
NONMETALS			
Abrasives, natural, n.e.s., emery and corundum	1,820	2,110	2,740
Asbestos [3]	r 2,256	4,360	NA
Barite e	54,497	43,066	33,900
Cement, hydraulic thousand tons	6,405	7,281	7,189
Diamond: [10] e			
Gem thousand carats	160	160	160
Industrial do	160	160	160
Total do	320	320	320

See footnotes at end of table.

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Table 1.—Brazil: Production of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969[p]
NONMETALS—Continued			
Fertilizer materials:			
Crude, phosphates: [11]			
Apatite	129,606	143,893	NA
Phosphate rock	33,772	3,430	NA
Manufactured, nitrogenous, nitrogen content	e 28,500	34,733	NA
Graphite, all grades	2,896	2,260	11,783
Gypsum and anhydrite, crude	71,450	216,798	e 220,000
Lime—thousand tons	r 1,340	1,514	NA
Lithium minerals [3]	6,169	-------	NA
Magnesite	109,253	137,820	e 140,000
Mica, all grades [3]	1,041	1,668	NA
Precious and semiprecious stone, except diamond:			
Agate, rough [3]	471	571	NA
Other stones, uncut [3]	340	236	NA
Other stones, cut [3]—kilograms	161	197	NA
Cuttings [3]	270	205	NA
Quartz, crystal, all grades [3]	3,407	2,400	NA
Salt, marine—thousand tons	1,040	1,536	1,630
Stone, sand, and gravel, n.e.s.:			
Dimension stone, marble	41,882	NA	NA
Crushed and broken, dolomite	224,972	353,091	NA
Sulfur, elemental, byproduct	6,210	6,925	7,250
Vermiculite	218	2,471	4,200
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	30,700	45,000	43,500
Coal, marketable, all grades—thousand tons	2,295	2,364	2,436
Coke:			
High-temperature—do	1,318	1,407	1,507
Gashouse—do	205	198	174
Gas:			
Manufactured, all types—million cubic feet	13,118	12,718	13,001
Natural:			
Gross withdrawal—do	30,888	34,726	45,317
Marketed production [4]—do	6,000	7,000	8,000
Natural gas liquids—thousand 42-gallon barrels	756	1,031	927
Petroleum:			
Crude—do	54,622	r 58,785	63,042
Refinery products:			
Gasoline and naphthas:			
Motor gasoline—do	43,019	46,842	53,589
Naphtha—do	[12] 30	381	422
Kerosine and jet fuel:			
Kerosine—do	4,762	5,335	4,977
Jet fuel—do	1,266	2,402	4,420
Distillate fuel oil—do	e 31,000	r 35,268	40,025
Residual fuel oil—do	e 41,100	r 46,467	54,967
Liquefied petroleum gases—do	([12])	4,167	4,092
Lubricants—do	-------	36	64
Asphalt and bitumen, refinery—do	([13])	4,167	4,092
Other—do	11,232	2,061	2,306

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Brazil also produces molybdenite, fluorspar, limestone, feldspar, clay and shale, stone, n.e.s., sand, and gravel, but production data are not available.

[2] Includes small quantity of metal contained in antimonial lead.

[3] Exports.

[4] Includes secondary metal.

[5] Officially reported and estimated. Much placer gold produced eludes statistical coverage.

[6] Production of Minas Gerais only.

[7] Total for two producers only.

[8] Production from Bahia and Goias, 1967–68. Asbestos is produced in three other States, but data are not available.

[9] Includes both ore and concentrate.

[10] By far the larger part of Brazil's diamond production is not reported statistically; hence the estimates tabulated are based only on very general market information.

[11] Data for 1967 and 1968 furnished by the São Paulo Sindicato da Industria de Adubos e Colas.

[12] PETROBRAS only.

[13] Included in "Other."

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TRADE

In terms of value, there was no important change in the direction of foreign trade. The United States remained Brazil's best customer for exports, with Western Germany in second place. About one-third of the import total came from the United States, with Western Germany the next most important supplier.

The following table shows total visible foreign trade compared with trade in mineral commodities for 1966, 1967, and 1968.

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1966	164	1,741
1967	183	1,652
1968	177	1,881
Imports:		
1966	515	1,497
1967	505	1,670
1968	598	2,132

Iron ore exports, valued at $149 million, were the highest ever recorded for that commodity, and in terms of value ranked in third place after coffee and raw cotton.

Table 2.—Brazil: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum:			
Bauxite and concentrate	2,230	8,244	Argentina 1,710.
Oxide (alumina) and hydroxide	1	(1)	All to Netherlands.
Metal, including alloys:			
Unwrought	184	849	Mainly to Colombia.
Semimanufactures	76	17	Mainly to Paraguay.
Beryllium, beryl ore and concentrate	1,310	2,078	Mainly to United States.
Chromium, ore and concentrate	45	55	All to Argentina.
Columbium and tantalum, ore and concentrate:			
Columbite and tantalite	306	334	Mainly to United States.
Pyrochlore	2,725	2,861	United Kingdom 830; United States 736; Netherlands 595; Austria 575.
Iron and steel:			
Ore and concentrate—thousand tons	14,279	15,050	West Germany 4,611; Japan 2,461; Italy 1,307; France 1,267.
Metal:			
Scrap	8,122	64	Japan 35; Argentina 20.
Pig iron	263,731	66,583	Argentina 29,692; United States 19,993; Japan 16,617.
Ferroalloys:			
Ferromanganese	310	80	All to Uruguay.
Ferrosilicon	105	31	Do.
Ferrochrome	60	65	All to Argentina.
Ferrocolumbium	481	988	United States 574; Sweden 195; Netherlands 190.
Ferronickel	2,678	1,531	West Germany 667; United Kingdom 339; Japan 257; Argentina 153.
Steel:			
Primary forms, ingot	r 75,938	130,786	Argentina 86,617; United States 31,520.
Semimanufactures	r 273,185	175,913	United States 118,183; Argentina 45,709.
Manganese, ore and concentrate	542,017	1,123,909	United States 495,226; United Kingdom 124,797; Norway 105,987.
Rare-earth metals, ferrocerium—kilograms	3,564	7,000	Italy 3,000; Argentina 2,000.
Tin, metal and alloys, unwrought—long tons	-------	5	All to Argentina.
Tungsten:			
Ore and concentrate	420	670	Belgium-Luxembourg 240; Netherlands 170; West Germany 150.
Metal, including alloys, all forms—kilograms	5,721	80	Mainly to Mexico.
Zinc, ore and concentrate	212	198	All to Belgium-Luxembourg.
Zirconium and hafnium, ore and concentrate	86	35	All to Argentina.
Other	581	629	Mainly to France.
NONMETALS			
Abrasives, emery, and corundum	897	500	Argentina 399.
Asbestos	15	20	Mainly to Italy.
Barite	49,068	12,292	All to Trinidad and Tobago.
Cement	14,269	7,053	Mainly to Bolivia.

See footnotes at end of table.

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Table 2.—Brazil: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
NONMETALS—Continued			
Clays and clay products:			
Crude clays, n.e.s., kaolin	960	1,425	All to Uruguay.
Products, refractory	923	981	Mainly to Paraguay.
Diamond:			
Gem, uncut and cut but unset...carats	15,145	4,340	Netherlands 1,955; United States 1,405.
Industrial.....do	11,970	1,620	Netherlands 835; Belgium-Luxembourg 745.
Fertilizer materials, manufactured	8	80	Uruguay 19.
Graphite, natural	8	-------	
Magnesite	4,700	4,578	Argentina 2,248; Belgium-Luxembourg 1,200; France 1,020.
Mica, all forms	1,045	1,668	United States 522; Norway 500; West Germany 330.
Precious and semiprecious stones[2]...kilograms	610,770	442,589	West Germany 183,721; United States 137,083; Japan 68,616.
Stone, sand and gravel, dimension stone:			
Crude and partly worked:			
Calcareous	366	284	Mainly to Argentina.
Other	8,495	8,929	Italy 4,577; Japan 1,809; United States 866; Spain 864.
Worked	82	193	Mainly to Belgium-Luxembourg.
Talc, soapstone, and pyrophyllite	225	369	Mainly to Colombia.
Other nonmetals, n.e.s.:			
Agate, rough...kilograms	471,130	571,454	West Germany 213,981; United States 155,960; Japan 121,659.
Lithium minerals:			
Spodumene	50	-------	
Other	6,119	-------	
Quartz crystal:			
Electronic and optical grade	112	72	United States 26; United Kingdom 14; Netherlands 10.
Other	3,310	3,526	West Germany 1,004; Japan 975; United States 438.
Slag, not metal bearing	5,624	15	All to Netherlands.
Other	38	22	Paraguay 15.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	50	561	Mainly to Uruguay.
Petroleum, refinery products; residual fuel oil...thousand 42-gallon barrels	620	190	Mainly to Argentina.

r Revised.
[1] Less than ½ unit.
[2] Excludes diamond and rough agate.

Table 3.—Brazil: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum:			
Oxide (alumina)	r 937	720	Mainly from West Germany.
Metal:			
Unwrought	28,014	31,505	Canada 19,336; United States 7,613; Norway 3,069.
Semimanufactures	1,087	1,337	France 656; Belgium-Luxembourg 238; West Germany 227.
Antimony:			
Ore and concentrate	236	231	Peru 130; Colombia 61.
Metal, including alloys, all forms	70	318	Czechoslovakia 144; Belgium-Luxembourg 100.
Arsenic, trioxide and regulus	637	545	Sweden 230; France 156; West Germany 148.
Bismuth, metal, including alloys, all forms...kilograms	9,685	19,632	Mainly from Mexico.
Cadmium, metal, including alloys, all forms...do	46,216	62,992	Do.
Chromium:			
Chromite	6,193	7,181	Mainly from Philippines.
Metal, including alloys, all forms	22	15	Mainly from Japan.
Cobalt:			
Oxide and hydroxide	36	55	Mainly from Belgium-Luxembourg.
Metal, including alloys, all forms	74	111	Belgium-Luxembourg 70; United States 19.
Columbium and tantalum, metal, all forms, tantalum	4	[1]	Mainly from West Germany.

See footnotes at end of table.

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Table 3.—Brazil: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS—Continued			
Copper:			
Copper sulfate	2,002	2,408	Peru 728; Chile 434; United Kingdom 343; Mexico 340; Argentina 302.
Metal:			
Scrap	39	386	Mainly from United States.
Unwrought:			
Refined, unalloyed	36,437	49,683	United States 23,094; Chile 7,970; West Germany 7,240; Zambia 5,992.
Alloys	(1)	5	United States 2.
Semimanufactures	482	698	West Germany 349; United States 253.
Gold, metal, unworked or partly worked troy ounces	21,606	81,856	Canada 31,508; United Kingdom 27,810; Switzerland 11,639.
Iron and steel, metal:			
Scrap	500	90	All from United States.
Sponge iron, powder, and shot	807	1,358	United States 1,040; Japan 247.
Ferroalloys	1,988	2,457	Republic of South Africa 880; France 515.
Semimanufactures	332,885	246,527	West Germany 85,643; Japan 66,698; United States 25,291.
Ore and concentrate	2	5	All from United States.
Lead:			
Oxides	596	1,116	Mainly from Mexico.
Metal, including alloys, all forms	6,518	11,763	Mexico 8,007; Belgium-Luxembourg 2,000.
Magnesium, metal, including alloys, all forms	1,985	3,069	United States 1,537; Norway 1,512.
Manganese:			
Ore and concentrate	287	297	All from United States.
Oxide	760	747	Mainly from Japan.
Metal	56	56	Republic of South Africa 35.
Mercury 76-pound flasks	717	2,357	Mainly from Mexico.
Molybdenum:			
Ore and concentrate	44	83	United States 56.
Metal, including alloys, all forms	10	5	Mainly from United States.
Nickel, metal:			
Scrap	84	1	All from United States.
Unwrought	387	583	United States 268; Canada 173.
Semimanufactures	458	660	United States 242; West Germany 184; France 67.
Platinum-group metals, including alloys, all forms:			
Platinum troy ounces	1,318	868	United States 354; West Germany 322; Italy 161.
Other do	1,993	5,305	United States 1,672; Italy 1,640; West Germany 1,125.
Radium milligrams	9	290	All from Canada.
Selenium, elemental kilograms	3,715	7,545	Canada 3,762; United States 3,279.
Silicon, metal	386	861	Norway 360; France 236; Sweden 150.
Silver, metal, including alloys, all forms troy ounces	907,710	1,003,488	Peru 263,507; West Germany 257,559; Canada 161,075.
Sodium, metal kilograms	6,527	11,266	Mainly from West Germany.
Tellurium, elemental do	192	92	All from United Kingdom.
Tin:			
Ore and concentrate long tons	1	---	
Oxides do	r 52	87	United Kingdom 36; Belgium-Luxembourg 30.
Metal, including alloys, all forms do	8	11	Malaysia 5; United Kingdom 2.
Titanium:			
Ore and concentrate, rutile	1,212	805	All from Australia.
Oxides	9,468	15,307	United Kingdom 5,857; West Germany 4,369; Finland 1,681.
Tungsten:			
Ore and concentrate, wolframite	10	---	
Metal, including alloys, all forms kilograms	5,822	5,375	Mainly from United States.
Uranium and thorium, isotopes and compounds value	$183,363	$107,522	Canada $55,405; United States $28,583.
Zinc:			
Oxide	38	88	West Germany 36; United States 36.
Metal:			
Unwrought	36,113	43,085	Mexico 17,043; Peru 9,841; Canada 6,678.
Semimanufactures	338	37	Belgium-Luxembourg 20.
Zirconium and hafnium, ore and concentrate	2,117	1,455	Mainly from Australia.
Other	2	62	Mainly from United States.

See footnotes at end of table.

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Table 3.—Brazil: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, tripoli, etc	718	937	Mainly from Italy.
Grinding flints	746	14	All from United States.
Asbestos	17,504	27,586	Mainly from Canada.
Barite	7	84	United States 69; West Germany 10.
Boron materials:			
Crude natural borates	1,957	2,710	All from United States.
Oxide and acid	981	1,422	Mainly from United States.
Bromine	5,347	253	Mainly from West Germany.
Cement	r 124,876	584,562	Uruguay 135,706; Rumania 117,285; Colombia 97,393; U.S.S.R. 66,257.
Chalk, natural	1,839	2,200	Mainly from France.
Clays and clay products:			
Crude clays, n.e.s.:			
Bentonite	5,497	7,933	United States 6,168.
Fire clay	37	65	United States 48.
Kaolin	919	1,751	Mainly from United States.
Other	356	968	All from United States.
Products, refractory	6,915	2,913	Austria 714; United States 669; West Germany 523; Italy 361.
Cryolite, natural	1,139	1,389	All from Denmark.
Diamond, industrial	---	5,000	All from United States.
Diatomite and other infusorial earths	1,387	684	United States 558; West Germany 116.
Feldspar	5	---	
Fertilizer materials:			
Crude:			
Nitrogenous, nitrates, natural	36,877	31,686	Mainly from Chile.
Phosphatic, phosphate rock	r 225,444	329,808	Mainly from United States.
Manufactured:			
Nitrogenous	350,272	482,290	United States 156,698; West Germany 150,928; Netherlands 51,199.
Phosphatic:			
Thomas slag	6,991	12,189	West Germany 7,862.
Other	103,598	231,600	Mainly from United States.
Potassic	226,890	307,397	United States 60,296; Israel 57,965; West Germany 57,122.
Other, including mixed	267	1,274	Mainly from Belgium-Luxembourg.
Fluorspar	26	---	
Graphite, natural	168	157	West Germany 95; Japan 50.
Gypsum and plasters	1,244	1,620	Mainly from Bolivia.
Iodine ..... kilograms	18,911	21,605	Chile 11,000; Belgium-Luxembourg 3,600.
Mica:			
Crude, including splittings and waste ..... do	100	29,577	United States 19,457.
Worked ..... do	22,287	9,062	United States 5,638; France 1,885.
Phosphorus, elemental	86	98	United Kingdom 49; West Germany 31.
Pigments, mineral, including processed iron oxides	3	2	Mainly from West Germany.
Precious and semiprecious stones, except diamond ..... grams	200,241	231,973	France 109,870; United States 84,228; West Germany 32,966.
Pyrite, gross weight	4	7,611	All from Spain.
Salt	49,098	651	Mainly from Rumania.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	127,848	193,223	United States 72,822; United Kingdom 30,527; West Germany 27,056.
Caustic potash	991	859	Mainly from United States.
Soda ash	2,001	4,021	Poland 2,998; United Kingdom 1,000.
Sodium sulfate	14,691	25,800	Mexico 19,782; East Germany 5,423.
Stone, sand, and gravel:			
Dimension stone, marble	85	933	Mainly from Italy.
Dolomite	112	533	All from Italy.
Sulfur, elemental, all forms	205,003	238,493	United States 163,223; Canada 27,738; Poland 21,507.
Talc, soapstone, and pyrophyllite	31	104	Mainly from Norway.
Other	8	---	
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	330	551	Mainly from United States.
Carbon black	5,356	5,226	Argentina 2,010; United States 1,914; West Germany 672.
Coal, all grades, including briquets	1,537,475	1,408,279	Mainly from United States.
Coke and semicoke	43,501	62,531	Mainly from West Germany.
Gas, hydrocarbon, natural gas liquids (LPG) thousand 42-gallon barrels	3,291	4,756	Mainly from Venezuela.

See footnotes at end of table.

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Table 3.—Brazil: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude—thousand 42-gallon barrels	78,224	93,812	Saudi Arabia 33,578; Iraq 22,789; Venezuela 15,905.
Refinery products:			
Gasoline—do	1,682	5,625	Netherlands Antilles 2,800; Iran 1,370; Venezuela 609.
Kerosine—do	13	1,570	Mainly from Netherlands Antilles.
Jet fuel—do	1,737	---	
Distillate fuel oil—do	147	---	
Residual fuel oil—do	348	3,260	Mainly from Venezuela.
Lubricants—do	2,067	2,439	Mainly from United States.
Mineral jelly and wax	24,254	30,444	United States 11,434; Rumania 7,379; East Germany 5,960.
Petroleum coke	22,743	30,205	Mainly from United States.
Bitumen and other residues	107	1,414	Do.
Mineral tar and other hydrocarbon-based chemicals	52,054	256,563	Trinidad and Tobago 93,779; Bahrain 77,862; Venezuela 71,589.

r Revised.
1 Less than ½ unit.

COMMODITY REVIEW

METALS

Aluminum.—Final approval was granted by the Government for the construction of an aluminum smelter by Alumínio Minas Gerais, S.A. (ALUMINAS), an affiliate of Alcan Aluminum, Ltd. (ALCAN). The smelter is to be built at the "Aratú Industrial Center" near Salvador in the State of Bahia. Initial planned production was put at 10,000 tons annually, with expansion to 50,000 tons in the medium term. Power will be supplied by the Paulo Alfonso dam at Maceio.

The initial investment of about $9 million will benefit from various tax and other incentives with which the Brazilian Government encourages new industry in northeastern Brazil. Expected startup date was set for December 1971.

ALCAN formed a subsidiary company, Mineração Rio do Norte, S.A., to operate a bauxite mining operation northwest of Obidas in the State of Pará. The projected mining site lies about 20 miles from the Amazon River, and plans were based on handling 1 million tons of ore annually; output would be shipped to ALCAN's alumina plant at Arvida, Quebec. Drying facilities were to be established on the Amazon River. Clay content of the mine-run ore necessitates washing, which would reportedly upgrade some of the ore to 60 percent Al_2O_3.

Ore reserves were not stated but were described as "very large."

Capital costs of the mining project were estimated at between $20 million to $25 million.

An aluminum products mill was to be built near Recife by Schloeman A. G. for Aluminium S.A. Extrusão e Laminação. The plant, scheduled to start up in 1971, was planned for initial output of 12,000 tons annually of strip up to 1.6 meters wide and foil with a thickness of 0.007 millimeters.

Cia. Mineira de Alumínio (ALCOMINAS) was reportedly ahead of its construction schedule for its 25,000-ton-per-year bauxite-alumina-aluminum complex at Poços de Caldas, Minas Gerais.

Iron Ore.—Cia. Vale do Rio Doce (CVRD), Brazil's largest mining company, continued its leading position in 1969 with iron ore output of 14,875,215 tons, or about 45 percent of total Brazilian production. Projected production rates suggest that CVRD may attain an output of 35 million tons annually from the Itabira district by 1974.

Cia. Siderúrgica Nacional (CSN) ranked second in iron ore production with nearly 3 million tons. CSN also recorded exports for the first time with a 3,000-ton shipment to Japan.

Of the nearly 20 million tons of iron ore exported in 1969, nearly 18 million tons were handled in CVRD's port at Tubarão, Espírito Santo. Of the total, over 16 million tons was ore mined by CVRD. Other companies which shipped ore through Tu-

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barão were S.A. Mineração Trinidade, FERTECO, S.A., and Administração e Fomento Industrial.

CVRD completed its pellet plant at Tubarão in 1969, and it was soon operating at the rate of planned capacity of 2 million tons annually. Fines come from Conceição and Itabira in the proportions of 65 and 35 percent, respectively. The product will be a 65-percent, plus, Fe pellet. Eventual planned pellet production by CVRD is for between 7 and 10 million tons per year.

In addition to expanding its present mining and shipping facilities, CVRD looked forward to further growth in undertaking a joint venture with United States Steel Corp. (USS). Amazonia Mineração, S.A. (CVRD—51 percent and USS—49 percent), was formed to develop what was considered a very large deposit of iron ore situated in the Serra dos Carajas region, Pará. Government approval of the joint venture was expected early in 1970. The desposit is similar to other Precambrian deposits with the iron ore association of itabirite, quartzite, and phyllite. Preliminary drilling revealed that the iron formation is 325 feet thick and that the ore grade is 65-percent iron. The prospecting license covers 395,000 acres.

Vale do Rio Doce Navegação, S.A. (DOCENAVE), a shipping subsidiary of CVRD, had four ships under construction in Japanese yards which were due for delivery in 1970. Two of the vessels were rated at 104,700-deadweight-tons (d.w.t.), and two at 130,000 d.w.t. The carriers are combination ore/oil tankers, to carry iron ore outbound and return crude oil to Brazil. Another ship being built for DOCENAVE in Brazil was rated at 53,500 tons.

The company was operating seven vessels ranging from 39,000 to 89,529 d.w.t. on a "time-charter" basis.

Iron and Steel.—The steel industry established alltime production records for pig iron, ingot steel, and rolled products in 1969. Compared with the preceding year, percentage rises were, pig iron, 11; ingot steel, 10.9; and rolled products, 14. Actual output for the respective categories, in metric tons, was: Pig iron—3,766,698; ingot steel—4,914,808; and rolled products—3,903,331. CSN was the chief producer on a percentage basis; Pig iron—24; ingot steel—28; and rolled products—27.

Planning for expansion of steel output was progressing on a broad scale. The Ministry of Industry and Commerce estimated that $1.3 billion must be invested in the steel industry through 1974. Expansion plans were based on an expected increase annual steel production to 15 million tons.

Manganese.—What was said to be the world's first manganese ore pelletizing plant was to be built at Santana, Territory of Amapá, for Indústria e Comércio de Minérios, S.A. (ICOMI). Arthur G. McKee and Co. was awarded the contract for actual construction of the plant, which was planned for completion in 1970. Planned capacity was 235,000 tons of 56-percent manganese (Mn) pellets annually; the product was destined to be used as feed for the making of ferromanganese. The Export-Import Bank of the United States loaned ICOMI $5.5 million of the total required investment of $15 million.

In 1969 ICOMI shipped a record 1,085,000 tons of high-grade manganese ore. More than 52 percent went to the United States and Canada, with nearly 44 percent destined for Europe and Great Britian.

Nickel.—Some interest was shown in Brazil's nickel possibilities by various companies. Four Japanese firms proposed a pressure from the Brazilian Government to mine ore in the Ipanema, Minas Gerais, area for shipment to Japan. Exploration work revealed an ore body of 300,000 to 500,000 tons averaging 1.9 percent nickel. Because the ore body was of lesser tonnage and lower grade than was originally estimated and because in addition there was pressure from the Brazilian Government to erect a ferronickel processing plant, the Japanese combine withdrew from the project.

Uranium.—According to the Mining World,[3] the Comissão Nacional de Energia Nuclear announced the discovery of 1 million tons of uranium ore grading 16 pounds of U_3O_8 per ton of ore. The ore, found on the Poços de Caldas plateau, was said to be zirconium free and nonrefractory.

The Comissão[4] also released the following estimates of available uranium reserves

[3] Mining World. V. 5, No. 3, March 1969, p. 53.
[4] World Mining. V. 5, No. 9, August 1969, p. 59.

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Table 4.—Brazilian uranium reserves, in metric tons, for three uranium prices

Type of reserves, origin	Price per pound of U_3O_8			
	Below US$10		US$10 to $15	Above US$15
	Measured	Possible additional	Measured	Possible additional
Poços de Caldas [1]	500	500	-----	400
Araxa [2]	200	-----	3,500	2,000
Jacobina [3]	-----	-----	-----	2,000
Olinda [4]	-----	-----	-----	42,000
Total	700	500	3,500	46,400

[1] This refers to the Campo de Agostinho ore assaying 0.15 percent U_3O_8 (amorphous uranium, associated with fluorite, and molybdenite). This is not caldasite ore with zirconite and baddeleyite.
[2] Uranium associated with pyrochlore.
[3] Uranium associated with gold in metaconglomerate.
[4] Associated with phosphorite.

calculated on a U.S. dollar price ranging from below $10 per ton to plus $15 per ton.

NONMETALS

Cement.—Cement production continued to expand in Brazil with output of 7.8 million tons; of the total, 591,000 tons originated from blast furnace slags, 42,000 tons were white cement, and 43,000 tons were pozzolanic. The pozzolanic type was produced for the first time in Brazil in 1969 by S.A. de Cimento Portland Rio Grande do Sul.

In spite of increasing output, the shortage of cement for domestic use was severe enough so that the Government increased the cement import quota from 450,000 tons in 1968 to 2 million tons in 1969 and lowered the ad valorem duty from 37 percent to 15 percent.

Cement was produced at 31 plants operated by 30 companies in 15 States. At year-end, six new plants were reportedly under construction with a total capacity of 1.3 million tons, and four plants were planned with a total capacity of 510,000 tons.

Fertilizer Materials.—Fertilizantes Mitsui, S.A., commenced operation of its thermophosphate plant at Poços de Caldas, Minas Gerais. Fused magnesium phosphate was produced from Araxa apatite and magnesium silicate scoria from Morro do Niquel's plant at Pratãpolis.

The one electric furnace in operation had a rated capacity of 25,000 tons annually. It was planned that future expansion would bring output up to 75,000 tons annually.

The product, sold under the trade name "Yoorin," contained about 20 percent citric soluble phosphorus, 19 percent MgO, and 30 percent CaO. About 4 percent is made up of minor elements including iron, manganese, molybdenum, cobalt, and copper.

A study of the potassium deposits in the State of Sergipe revealed a reserve of 208 million tons of recoverable sylvinite—a mixture of sylvite and halite. Projected possible production was for about 500,000 tons per year for the domestic market only.

The area was put under the jurisdiction of the Government exploration company—CPRM—for development by private enterprise on a basis of public bids.

Sulfur.—Petróleo Brasileira, S.A. (PETROBRÁS), continued to expand its sulfur recovery facilities. The 40-ton-per-day recovery plant at the Duque de Caixas refinery was planned for completion in 1970; the 15-ton-per-day production units at the Alberto Pasqualini and the Gabriel Passos refineries were expected to be in operation in 1971. In addition, the 40-ton-per-day Planalto unit at Paulinia was due to commence operations in 1972.

PETROBRÁS's pilot plant, planned to produce 30 tons of sulfur per day from domestic oil shale, was expected to start production in 1970. The long-term plan for this project contemplates an eventual sulfur output of 320 tons per day if experimental work proves successful.

Siderúrgica de Santa Catarina (SIDESC) contracted with a Japanese firm to build two plants to concentrate pyrite that is recovered from the Santa Catarina coal beneficiation process. The pyrite will be used as feed to a sulfuric acid plant to be built at Imbituba; planned annual output of the plant was 300,000 tons of 98-percent sulfuric acid, 155,000 tons of iron oxide

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cinders (55-percent iron), and 100 million kilowatt hours of electric power. Total investment was put at $18 million with completion scheduled for 1972.

MINERAL FUELS

Coal.—Although run-of-mine coal output continued to increase at a fairly rapid rate, the ratio of washed coal to total output continued to decline, and useable production rose only 3 percent in 1969. Output of coal mined and washed, by States, during 1968 and 1969 follows, in thousand metric tons:

State	1968		1969	
	Run-of-mine	Washed	Run-of-mine	Washed
Paraná	343	217	415	253
Rio Grande do Sul	996	858	1,006	872
Santa Catarina	3,490	1,289	3,707	1,311
Total	4,829	2,364	5,128	2,436

During 1969, Powell Duffryn Technical Services, Ltd., a United Kingdom firm, was named to evaluate proposals for the mechanization of the coal mines in the State of Santa Catarina.

Petroleum and Natural Gas.—Brazil's crude oil output rose 7 percent to 173,000 barrels per day during 1969. However, the country's petroleum requirements also continued to increase, and domestic crude oil production accounted for only about 37 percent of Brazil's needs during the year. The gross withdrawl of natural gas rose 30 percent to 124 million cubic feet per day in 1969, but only an estimated 18 percent of total output was marketed production. Output of natural gas liquids dropped approximately 10 percent during the year. All production of crude oil, natural gas, and natural gas liquids was accounted for by the Government oil entity, PETROBRÁS.

Proved reserves of crude oil increased 30 million barrels to a reported total of 852 million barrels as of yearend 1969. Natural gas reserves, as of the same date, totaled 904 billion cubic feet, 42 billion cubic feet less than at yearend 1968.

Geologic and geophysical exploration and exploratory, development, and injection drilling activities, all of which were performed by PETROBRAS or its contractors, were as follows:

	1968	1969
Geologic and geophysical exploration:		
Geologic surveying party months	115	122
Seismic surveying do.	85	82
Gravimetric surveying do.	22	----
Magnetic surveying do.	5	5
Electroresistivity sounding do.	20	----
Structural drilling do.	12	----
Total do.	259	209
Drilling:		
Wells drilled:		
Exploratory:		
Oil number	24	15
Gas do.	7	5
Dry do.	84	66
Subtotal do.	115	86
Development:		
Oil do.	99	58
Gas do.	----	1
Dry do.	16	20
Subtotal do.	115	79
Injection do.	1	10
Total do.	231	175
Footage drilled thousand feet	1,152	514

Offshore exploration activity was intensified markedly during 1969 especially on the Continental Shelf near the mouth of the Amazon and along the coastal areas of the States of Sergipe-Alagoas, Bahia, Espírito Santo, and São Paulo. A new mobile offshore drilling platform, Penrod-59, was placed in service on the Continental Shelf during the year, and two more mobile platforms were expected to be contracted for in 1970. Of the 11 exploratory wells drilled on the Continental Shelf during 1969, three were crude oil producers and one produced natural gas.

The combined crude oil distillation capacity of Brazil's refineries was increased to 475,000 barrels per day in 1969 by the completion of a 17,000-barrel-per-day atmospheric distillation unit at PETROBRÁS' Mataripe refinery. Approximately 88 percent of the country's total refining capacity was operated by PETROBRÁS while only 12 percent was accounted for by privately owned refineries.

PETROBRÁS continued to expand its refinery facilities during 1969. Construction was in progress on a new refinery near Campinas; initial crude oil distillation capacity is planned at 126,000 barrels per day. A lubricants unit with capacity of 4,700 barrels per day was being added to the Duque de Caxias plant where catalytic cracking and asphalt facilities were also being expanded. Work was proceeding on the modernization of the Cubatao refinery

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where throughput capacity is to be increased 45,000 barrels per day.

The PETROBRÁS oil unloading terminal at São Sebastião was inaugurated in April 1969. This terminal, which is connected to the Cubatão and Capuava refineries by a 120-kilometer crude oil pipeline, has an unloading capacity of 275,000 barrels daily and storage facilities with a combined capacity of 1.7 million barrels. It can accommodate tankers of up to 115,000 d.w.t. and is one of the largest petroleum terminals in South America.

Work continued at an accelerated pace during 1969 on the PETROBRÁS prototype shale oil plant at São Mateus do Sul in the State of Paraná. By yearend, the plant's major facilities such as the retort, solids preparation unit, powerhouse, and sulfur recovery unit, were well on the way toward completion. This 1,000 barrel per day plant, when completed late in 1970 or early in 1971, will test the economic and technical feasibility of producing oil from Irati shale which will be obtained from an open pit mine adjacent to the plant site.

No progress was reported with respect to the proposed oil shale gasification project of Cía. Industrial de Rochas Betuminosas (CIRB) at Pindamonhangaba, São Paulo.

Construction was initiated during April 1969 on the Petroquimica União, S.A., petrochemicals complex at Capuava, São Paulo. This petrochemicals complex, which will be the largest in Brazil when completed, is to have the capacity to convert over 1 million tons of naphtha annually to ethylene, benzene, propylene, xylene, toluene, and other products. Petroquimica is a consortium in which Petrobrás Quimica, S.A. (PETROQUISA), Refinaria e Exploração de Petróleo União, S.A., and Moreira Salles Banking Group each holds a 25-percent interest with the Pery Igel-Uttragas Group holding 15 percent and International Finance Corp. 10 percent.

Another important petrochemicals project in progress during 1969 was the expansion program at the Union Carbide do Brazil plant Cubatão. This expansion, scheduled for completion by mid–1970, will enable the plant to produce up to 128,000 tons of ethylene and a combined total of 36,000 tons of benzene and acetylene annually. It will also increase the plant's low density polyethylene output capacity from 19,500 to 88,200 tons per year.

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The Mineral Industry of Bulgaria

By Bernadette Michalski [1]

Bulgaria's mineral industry is of minor significance in terms of total world production. The nation's leading mineral industry branch, nonferrous base metals, contributed in 1969 less than 4 percent of the total world lead output, less than 2 percent of the zinc output, and less than 1 percent of the copper output. Despite the industry's modest role by world standards it has been of considerable significance to the domestic economy, both as a basis for general development and as an earner of foreign exchange, particularly in view of the nation's unfavorable mineral trade balance. In 1969 expanded copper production made Bulgaria self-sufficient in all nonferrous base metals except aluminum, with an exportable supply of approximately 55,000 tons of zinc and 40,000 tons of lead. These exports are among the very few mineral commodities shipped to the western world, and afford Bulgaria an opportunity to trade at world market prices.

Bulgaria produces a variety of nonmetallic minerals, most of which are consumed domestically with only small quantitites of cement, fertilizers, barite, and talc exported.

The Bulgarian mining industry provides little toward fulfilling the nation's fuel requirements. Domestic solid fuel output is virtually limited to low-ranking coals, and petroleum production is negligible, thereby requiring costly imports of solid fuels, petroleum, and petroleum products. Fuel imports constitute more than a third of the total mineral commodity imports by value. The domestic iron and steel industry satisfies about half of the nation's requirements for steel products; however, iron and steel product imports constitute nearly a third of the total mineral commodity imports by value.

PRODUCTION

Data on Bulgaria's 1969 mineral output were incomplete at this writing; for most major commodities, figures were available for only the first 9 months of the year. With the exception of copper and petroleum, mineral commodity production remained approximately the same. The increase in copper output reflected increased mining activity and full-capacity operation of the Pirdop smelter. The decline in crude petroleum production was significant; however, the impact on the refining industry was negligible as domestic production contributes less than 6 percent of the nation's petroleum requirements. Refinery output, based principally on imported crudes, increased by an estimated 38 percent.

[1] Foreign mineral specialist, Bureau of Mines, Washington, D.C.

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Table 1.—Bulgaria: Production of selected mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969 p
METALS			
Copper:			
Mine output, metal content—tons	35,100	37,300	e 38,000
Blister, including secondary—do	34,400	38,200	e 42,550
Refined electrolytic, including secondary—do	33,500	36,500	e 40,000
Iron and steel:			
Iron ore and concentrate	2,498	2,645	2,700
Pig iron (including blast furnace ferroalloys)	1,028	1,109	1,200
Steel ingots and castings	1,239	1,461	1,515
Steel semimanufactures (total)	609	1,028	e 1,200
Lead:			
Mine output, metal content—tons	86,100	86,200	e 82,500
Metal, including secondary—do	96,600	92,700	e 95,200
Manganese ore, gross weight	44	41	e 41
Zinc:			
Mine output, metal content—tons	68,100	e 70,000	e 63,400
Metal, including secondary—do	73,900	75,100	e 77,300
NONMETALS			
Asbestos—tons	1,500	2,100	2,200
Cement, hydraulic	3,358	3,516	3,552
Fertilizer materials, manufactured:			
Nitrogenous, gross weight	986	1,100	e 1,300
Phosphatic:			
Gross weight	278	409	e 450
Phosphorus pentoxide—content	89	135	e 150
Gypsum and anhydrite:			
Crude	152	194	e 200
Calcined	15	15	17
Kaolin	125	127	130
Lime (quicklime)	962	970	970
Pyrite:			
Gross weight	164	164	e 170
Sulfur content	65	65	67
Salt (all types)	114	118	120
Sulfur, elemental, recovered—tons	8,321	8,658	e 8,700
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite (marketable)	188	176	180
Bituminous (marketable)	280	263	250
Lignite and brown (marketable)	26,739	28,282	28,600
Coke, all types	803	817	820
Natural gas—million cubic feet	11,605	17,870	18,000
Petroleum:			
Crude oil	499	475	325
Refinery products:			
Gasoline, all types	595	605	
Kerosine	92	100	
Distillate fuel oils, diesel oil	942	1,010	e 4,600
Residual fuel oil	1,448	1,500	
Lubricants	46	49	
Asphalt, refinery and natural	55	58	

e Estimate. p Preliminary.

[1] Bismuth, cadmium, gold, silver, barite, chromite, and tellurium are also produced, but level of output is unknown.

Sources: Statisticheski Godishnik na Narodna Republike Bulgaria—1969 (Statistical Yearbook of the Peoples Republic of Bulgaria for 1969). Sofia, 1969, 618 pp. Statistical Office of the United Nations. Monthly Bulletin of Statistics. V. 24, No. 4, April 1970.

TRADE

Bulgaria maintained an unfavorable trade balance in mineral commodities in 1968. By far the major portion of mineral trade is conducted with the U.S.S.R. Exports to the Soviet Union totaled US$17 million [2] in 1968, while imports from the Soviet Union were more than $302 million for the same year. About $89 million was expended on petroleum and petroleum products imported from the U.S.S.R.

Future trends indicate an even closer integration with and dependence upon the U.S.S.R. Regulations were adopted in 1969 consolidating the Bulgarian state monopoly on foreign trade by affording the state the exclusive right to plan, organize, and man-

[2] Values have been converted from U.S.S.R. rubles to U.S. dollars at the rate of 1 ruble= US$1.11; however, values are probably derived by negotiated agreement between U.S.S.R. and Bulgaria, resulting in the above figures being more representative of a general range rather than actual world market price value for the mineral commodities.

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age all foreign trade activity. Highlights of the legislation include requiring all foreign trade organizations to obtain permission from the Foreign Trade Ministry to conclude any contracts and the placing of all Bulgarian trade missions in foreign countries under supervision of the Bulgarian diplomatic staff. An extensive punishment code for infractions and violations of the 1969 trade regulations has been published.

Table 2.—Bulgaria: Trade with the U.S.S.R. in selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968
EXPORTS		
METALS		
Iron and steel, semimanufactures	58,400	138,800
Lead metal, including alloys, unwrought [2]	3,400	3,200
NONMETALS		
Barite	28,100	27,500
Talc	12,200	22,100
IMPORTS		
METALS		
Aluminum metal, including alloys: [3]		
Unwrought	14,900	17,600
Semimanufactures	2,097	4,498
Antimony metal, including alloys, all forms	326	401
Copper metal, including alloys, semimanufactures	r 2,102	2,899
Iron and steel, ore and concentrate—thousand tons	954	764
Pig iron	157,200	208,300
Ferroalloys, all types	10,800	12,000
Semimanufactures: [4]		
Bars, rods, angles, shapes, and sections:		
Wire rod	41,500	146,100
Angles, shapes, and sections	208,800	314,900
Universals, plates, and sheets:		
Tinned plate	25,000	82,100
Other plates and sheets	112,700	116,500
Rails and accessories	35,900	35,600
Wire	7,303	8,616
Tubes, pipes, and fittings	r 48,700	62,000
Other	12,500	18,700
NONMETALS		
Asbestos	17,500	20,600
Cement	184,000	107,000
Clay products, refractory, including brick	31,400	45,400
Fertilizer materials: [5]		
Crude, phosphatic	274,500	363,400
Crude, potassic	36,400	91,900
Manufactured, phosphatic	53,100	88,300
Graphite	2,000	900
MINERAL FUELS AND RELATED MATERIALS		
Carbon black and gas carbon	5,040	6,503
Coal, anthracite and bituminous—thousand tons	3,231	3,422
Coke and semicoke—do	195	200
Petroleum:		
Crude—do	r 2,623	e 3,000
Refinery products—do	r 1,905	e 2,500

e Estimate. r Revised.

[1] Trade statistics for Bulgaria in 1968 were not available in time for inclusion in this table. Trade with the U.S.S.R., the principal trade partner of Bulgaria, was compiled from the Soviet source, Vneshnyaya Torgovlya SSSR za 1968 God (Foreign Trade of the U.S.S.R. for 1968), Moscow, 1969, pp. 113–122.

[2] An estimated additional 35,000 tons was exported to West Europe in 1968.

[3] An estimated additional 10,000 tons was imported from West Europe in 1968.

[4] An estimated additional 100,000 tons was imported principally from Austria, Czechoslovakia, and Poland in 1968.

[5] An estimated additional 800,000 tons of principally potassic and phosphoric fertilizers were imported from West Europe in 1968.

COMMODITY REVIEW

METALS

Copper.—Mining activity continued near Burgas, Malkotirnovo, and Panagiurishte.

Expanded copper mine output has probably resulted from the opening of an additional mine, the Chelopech, in the Panagiurishte region. All mine output is processed in Bulgaria. The Pirdop smelter was reportedly operating at full capacity (40,000 tons annually) during 1969. The smelter was employing a new variation in electrolytic refining. Italy and Japan have reportedly purchased licenses to duplicate this method.

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Iron and Steel.—A blast furnace of 1,033 cubic meters capacity was commissioned in September at the Kremikovtsi Iron and Steel Plant raising the total number of blast furnaces at the plant to three and raising the national total to five, including two at the Lenin Iron and Steel Plant at Pernik. A 100 ton electric furnace also was commissioned in 1969 at Kremikovtsi. The proposed further expansion of Kremikovtsi to include additional electric furnaces and sections for welded and seamless pipe is a point of Bulgarian controversy. Counter proposals favoring the construction of a third metallurgical complex near the Black Sea with more economic access to raw materials gained momentum. While the decision on the location of additional steel capacity was pending at yearend, the Bulgarians have assured additional ingot supply by signing an agreement with the U.S.S.R. for delivery of 3 million tons of steel ingots between 1971 and 1975.

Satisfying more than half of steel product consumption requirements, the 1969 domestic product output, consisting principally of heavy sections and plates, exceeded 1 million tons. The bulk of steel product imports were in the form of angles, shapes, light sections and plates, wire rod, tubes, pipes, and fittings.

Lead–Zinc.—The lead–zinc industry remained relatively stable throughout the year with development and construction activity focused on the 1-million-tons-annual-capacity Osogovo mine and flotation plant near Bulgaria's western border.

NONMETALS

Bulgaria's recorded production of nonmetallic mineral commodities includes asbestos, cement, fertilizer materials, gypsum, pyrite, refractory clays, and byproduct sulfur (the latter recovered from metallic sulfide ores), together with unreported quantities of barite and wide range of traditional construction clay and stone. Production of most of these commodities remained stable, with little development activity reported in 1969. Fertilizer output, however, advanced, as one facility commissioned in 1968 completed its first full year of production.

Cement and Other Construction Materials.—Work continued on a 1.6-million-ton-per-year cement plant and an automated brick and tile factory, both near Loukovit in northern Bulgaria. The cement plant, reputedly the largest in the Balkans, was slated for completion in May 1970; the brick and tile factory was scheduled for earlier completion.

Fertilizer Materials.—Bulgaria has no significant economic resources of phosphatic and potassic fertilizer raw materials, and thus is dependent upon imports of either crude materials or manufactured fertilizers to meet essential needs for these commodities. The country has however essentially achieved selfsufficiency in nitrogenous fertilizer materials. The most recent available trade information indicated imports of about 50,000 tons of manufactured nitrogenous fertilizers annually during 1966–68 (from France in 1966–67 and from Yugoslavia in 1968), while Bulgarian exports of nitrogenous fertilizer materials (urea and other unspecified nitrogenous) totaled almost 89,000 tons in 1966 and 108,000 tons in 1967 (1968 data not available).

In 1968 however Bulgarian imports of crude phosphate (including apatite) from the Soviet Union (as measured by U.S.S.R. exports) increased by nearly 90,000 tons, while manufactured phosphatic fertilizer exports to Bulgaria from Yugoslavia, the U.S.S.R., and Greece totaled almost 518,000 tons. Completion of the Varna facility may make possible a reduction in foreign spending for the higher unit value manufactured fertilizers, but could necessitate increased crude phosphate imports.

Regarding potassic fertilizer materials, the only information available on trade is the quantity of Soviet exports to Bulgaria, which reached almost 92,000 tons in 1968, a 150-percent increase over those of 1967 and 301 percent greater than those of 1966. The entire import from the Soviet Union is classified as crude potassium salts.

Through yearend 1969, the principal operating fertilizer facilities in Bulgaria were the Stara Zagora plant with an annual capacity of 200,000 tons of contained nitrogen in the form of high-grade ammonium nitrate; the Vratsa Chemical Complex (completed in 1968), with a reported annual capacity of 600,000 tons of urea; and the Dimitrograd complex, with an annual capacity of 95,000 tons of contained nitrogen in the form of ammonium nitrates. These facilities had been planned and built with foremost regard for domes-

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tic fertilizer requirements, particularly with concern for the specific types of materials needed for Bulgaria's agricultural specialities, but nonetheless were provided with sufficient capacity when built to permit development of the fairly significant export trade.

Construction continued on a major addition to Bulgaria's fertilizer productive facilities in 1969. A $40 million installation, being built near the city of Varna on the Black Sea coast by a French-British-Belgian corporation group on a contract basis is scheduled for completion in mid 1970. It reportedly will be capable of producing daily 630 tons of ammonia, 850 tons of ammonium sulfate, and 2,500 tons of end-product complex nitrogenous-phosphatic fertilizers.

MINERAL FUELS

Bulgarian energy consumption in 1969 was estimated at about 27.8 million tons of standard coal equivalent (SCE), excluding any estimates for the SCE equivalent of fuelwood or fuel dung. While detailed statistics showing the sources of the energy consumed are not available for 1969, available data suggest that imported and domestic solid fuels accounted for about 65 percent of the total. In 1967, the latest year for which a breakdown of energy consumption by source fuel is available, solid fuel provided 68.4 percent, petroleum 28.8 percent, natural gas 1.7 percent, and hydroelectric power 1.1 percent of a total of 25.4 million tons SCE.

Coal.—Total coal production exceeded 29.8 million tons in 1969. Low-quality lignite and brown coals constituted 96 percent of this total. Lignite and brown coal production edged slightly upwards, following the previous year's sharp rise that resulted from the opening of two mines, the Troyanovo 2 and the Troyanovo 3 in the Maritza Istok Basin, each with 2 million tons' annual capacity.

Bulgaria's requirement for high-rank coal and coke continued to be met through imports from the U.S.S.R., Czechoslovakia, and Poland.

Natural Gas.—The discovery and exploitation of the natural gas reserves at Tcherven added a new dimension to the nation's energy supply. This fuel contributed an estimated 3 percent of the total energy consumption in 1969. However, natural gas will play a more significant role when the proposed 435-mile pipeline between the Ukrainian S.S.R. and Sofiya is completed in 1975. The pipeline has a proposed annual capacity of 106,000 million cubic feet. The first stage, connecting Izmail, Varna, and Burgas, is scheduled for completion in 1972. Construction of the pipeline will continue westward to Ploviv and eventually to Sofiya.

Petroleum.—Bulgarian crude oil production fell precipitously in 1969. Traditional producting fields, led by the light-crude-oil-producing Dolni Dubnik field in northwestern Bulgaria, collectively recorded considerably lower output, while the much publicized Soviet-sponsored Black Sea operations north of Varna, which were being looked to as at least an alternate source and perhaps as a basis for expanding national production, apparently fell far short of their anticipated potential. A discovery near the village of Shabla in the Black Sea area, reported in 1968 after 3 years' exploratory work, was judged unsuccessful, and, it appeared that no further work would be conducted in this vicinity. The structure drilled at Shabla was said to be an offshore extension of Bulgaria's oldest oilfield.

Despite the crude oil production decline, the refining industry increased its volume of production by an estimated 38 percent over that of 1968. Bulgaria's sole petroleum refinery, the Burgas refinery and petrochemical complex, processed more than 4 million tons of crude, yielding about three-fourths of the nation's petroleum product requirement in 1969. At least 3 million tons of crude was supplied by the U.S.S.R., a traditional source; however, this crude supply may have been supplemented by imports from the El Morgan field in the United Arab Republic. The U.S.S.R. will nonetheless continue to be Bulgaria's principal crude petroleum source at least through 1975. An agreement between Bulgaria and the U.S.S.R. stipulates the import of 5.5 million tons of crude in 1971. By agreement, this quantity will be progressively augmented annually, reaching 10 million tons in 1975. Crude imported dur-

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ing 1971–75 totals 38.5 million tons, or more than twice the amount affected by the previous Bulgarian–U.S.S.R. agreement of 1966–70.

Construction of the Pleven refinery and petrochemical complex, the nation's second refinery complex, was near completion at yearend. The Soviet designed and equipped 1-million-ton-annual-capacity plant was scheduled for test runs by mid–1970.

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The Mineral Industry of Burma

By Ta Li [1]

Burma's mineral industry had another lackluster year in 1969. Production from the historically famous Bawdwin lead-silver-zinc enterprise near Lashio and the Chinese border remained at its lowest level within a decade. Tin and tungsten output also remained at low levels. Development of the Monywa district's copper deposits, with estimated reserves of 14 million tons of 0.5 to 1.0 percent copper ore, progressed very slowly.

Although crude oil production increased, the planned self-sufficiency goal was not reached, and crude oil as well as some refinery products were imported to meet domestic demand. Onshore oil exploration activities were to be increased in 1969–70 and, for the first time, offshore activities were planned. The Burmese approached the West Germans for help in exploring areas off the Arakan coast. This was the first sign that Burma might be considering opening its oil industry to foreign participation, closed since the nationalization of the oil industry in 1963.

Under the current 4-year national economic plan ending in 1969–70, special attention was given to mineral development, which was to be financed entirely from domestic sources. The fiscal 1969–70[2] budget for national development showed the following anticipated capital expenditures: People's Oil Industry (POI), $11.8 million; People's Bawdwin Industry (PBI), $2.1 million; and Mineral Development Corporation (MDC), $1.7 million.

Although Burma no longer produces any mineral in quantities of world consequence, significant resources possibly exist. Little progress has been made toward their development, however, due to the shortage of managerial and technical talent in the country, lack of capital funds to purchase the required equipment, and Government policy against foreign private investment in the mineral industry. As a result, the Government in recent years has concentrated much of its efforts on less capital consuming ventures such as geological surveys and exploration work.

PRODUCTION

The bulk of Burma's mineral output came from State enterprises, with the Government outproducing private industry by about 5 to 1. Only some small tin-tungsten and nonmetal mines were in private hands and a significant quantity of their production was believed to be smuggled out of the country and hence not recorded.

According to official Burmese national budget estimates, total "mining" output in fiscal 1968–69 amounted to $41.1 million. Crude oil and limestone are included in this figure but not the value added derived from mineral and metal processing. Reported values for major minerals produced were as follows: Crude oil, $16.6 million; nonferrous output of Bawdwin enterprise, $7.2 million; salt, $3.3 million; and tin and tungsten concentrates, $2.4 million. In addition, cement output was valued at $5.0 million.

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[1] Mining engineer, Bureau of Mines, Washington, D.C.

[2] Burma's fiscal year is October to following September. All values have been converted at the rate of 4.76 Kyat to US$1.

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Table 1.—Burma: Production of mineral commodities [1] [2]

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Antimonial lead (18 to 20 percent Sb)	400	280	300
Copper matte, gross weight	180	150	160
Iron and steel:			
Steel ingots and castings	21,000	21,000	21,000
Steel semimanufactures	26,000	28,000	25,000
Lead:			
Concentrate (50 to 60 percent Pb)	18,000	17,000	17,000
Metal	13,000	9,000	10,000
Nickel speiss (20 to 30 percent Ni)	130	115	115
Silver, metal thousand troy ounces	1,000	900	1,000
Tin concentrate (68 to 72 percent Sn) long tons	400	300	300
Tin-tungsten concentrate (35 percent Sn and 30 percent WO_3) long tons	450	500	400
Tungsten concentrate (55 to 65 percent WO_3)	95	130	130
Zinc concentrate (54 to 56 percent Zn)	8,400	8,500	9,000
NONMETALS			
Barite	9,400	9,600	8,200
Cement, hydraulic thousand tons	130	160	200
Gypsum	300	2,900	1,800
Limestone, crushed and broken thousand tons	400	520	550
Salt do	132	130	180
MINERAL FUELS AND RELATED MATERIAL			
Petroleum:			
Crude oil thousand 42-gallon barrels	4,580	5,634	6,085
Refinery products:			
Gasoline, aviation and motor do	1,240	1,112	1,142
Kerosine and jet fuel do	1,321	1,564	1,662
Distillate fuel oils do	1,970	1,763	2,432
Others do	423	401	598
Total do	4,954	4,840	5,834

[1] Fiscal year October through September. Figures are for first 9 months of year noted and 8 months of previous year.

[2] All production figures are estimates based upon official Government budget figures.

TRADE

The value of Burma's 1968–69 exports of metals and ores was estimated on a preliminary basis at $9.2 million, more than double that of the previous year. About half of the exports came from the Bawdwin mine's output of lead, zinc, and silver. The remaining exports were mostly composed of tin and tungsten concentrates. The increase in exports was partly caused by high 1969 market prices for nonferrous metals, which induced the Government to release its metal stockpiles held during periods of low metal prices.

Burma imported over $13 million worth of mineral and mineral related products in 1968–69 as compared with the $33 million in 1967–68. Smaller purchases of metals and metal manufactures ($10.5 million as compared with $19.2 million in 1967–68) were made in 1968–69. Manufactured fertilizer purchases were also reduced ($2.8 million as compared with $11.8 million in 1967–68).

COMMODITY REVIEW

METALS

Iron and Steel.—The Ywama steel mill, with an electric furnace and rolling mill, remained the country's only steel producer. Formerly, the electric furnace's scrap iron requirements were met by imports but, due to foreign exchange shortages, recent supplies have come from domestic sources. The rolling mill, reportedly rated at 40,000 tons of products annually, produced only an estimated 25,000 tons. Products include approximately 15,000 tons of bars and rods; 3,500 tons of wire nails; and 2,000 tons each of galvanized iron and barrel sheets.

Burma has plans for an integrated steel industry, based upon domestic resources. However, known deposits of coal and iron ore are low grade and located in areas

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where large investments in transportation facilities would be required. Accordingly, plans remained rather uncertain.

Lead, Zinc, Copper, Silver, and Nickel.—The PBI mine, located near Namtu in northern Shan State, continued to be Burma's sole significant producer of nonferrous metals. The Bawdwin mine has been producing lead, zinc, silver and byproduct copper matte, nickel speiss, and antimonial lead for many decades. Lead concentrates are shipped to Namtu for smelting, and zinc concentrates are exported, mostly to Japan.

Recent output from the mine has been only about one-fifth of the pre-World War II levels. Estimates of production for fiscal year 1968–69 were as follows: Refined lead, 9,500 tons; zinc concentrates, 9,000 tons; silver, 1 million ounces; antimonial lead, 300 tons; copper matte, 115 tons; and nickel speiss, 160 tons.

The decline of the Bawdwin mine is principally attributed to depletion of high-grade reserves and behind-schedule development of the lower grade ores. Reserves at yearend totaled approximately 6 million tons, assaying 11.2 percent lead, 5.6 percent zinc, 0.30 percent copper, and 7.8 ounces of silver per ton. Insurgent activity within the region, poor transportation, and inefficient mining techniques have also plagued the mine. In 1966, a United Nations Special Fund survey concluded that the output could be doubled through modernization of mine and enlargement of facilities. However, efforts on the part of the Burmese Government to obtain the necessary capital and equipment have not been successful.

Tin and Tungsten.—MDC continued to operate most of the country's tin and tungsten mines. Government policy calls for the eventual takeover of the remaining privately operated mines as soon as their licenses expire. Tin and tungsten concentrates were produced either separately or in mixed form; combined annual output of the two minerals has remained at the low level of roughly 1,000 tons of concentrates since 1966. In an effort to spur production, the Government reportedly signed a 4-year contract with the U.S.S.R. to rehabilitate the once-famous Mawchi tin-tungsten mine. The mine's high-grade reserves have been depleted and present efforts are being directed toward exploiting lower grade reserves.

NONMETALS

Fertilizer Materials.—Two chemical fertilizer plants, each with a 65,000-ton-per-year capacity, were being built at a cost of $14 million each. The first, located in Sale and constructed with Japanese aid for completion in 1969–70, was behind schedule. The other plant in Kyunchaung, northern Burma, being built with West German aid, was scheduled for completion in 1970–71.

Through 1969 Burma imported all its manufactured fertilizer needs. The country consumed about 140,000 tons in fiscal 1968–69, double that of the previous year.

MINERAL FUELS

Petroleum.—POI increased crude oil production to about 6 million barrels in fiscal year 1968–69; however, the industry did not reach the self-sufficiency target of 7 million barrels. Nevertheless, Burma was able to further reduce crude oil imports by 35 percent from the previous year, a decline of almost 72 percent since 1965–66.

The failure to reach the 1968–69 target was principally attributed to a much lower production rate than anticipated from two of the new fields, Prome and Shwepyitha. Due to a lack of crude, Burma's two refineries at Chauk and Syriam with a combined daily capacity of 26,300 barrels, continued to operate at less than full capacity.

Partly because of the unsatisfactory results at Prome and Shwepyitha, Burma lowered its estimates of known crude oil reserves from 200 million barrels to around 140 million. An extensive exploration program, both on and offshore, was planned by POI for the present fiscal year. On the basis of a successful seismic survey conducted by a Japanese concern off the Arakan coast, plans were made to drill a number of exploratory test holes. Onshore, exploration will encompass 10 regions covering 9,170 square miles and including for the first time the Northern Chin Hills and the Delta region.

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The Mineral Industry of Canada

By Lester G. Morrell [1]

Reflecting labor difficulties in the nickel, copper, and iron ore mining industries, Canada's mineral output valued at $4.34 billion [2] in 1969 was slightly below the record $4.38 billion of 1968 and reversed a steady growth trend that had held for 10 years. Suspension of The International Nickel Co. of Canada, Ltd. (Inco) and Falconbridge Nickel Mines Ltd. operations in Ontario for 18 and 13 weeks, respectively, was primarily responsible for the lower output of nickel, copper, and several byproduct metals. Shipments of iron ore from mines in Quebec, Labrador, and Ontario were 7.4 million metric tons lower than in 1968. The great bulk of this drop resulted from the strikes that lasted 15 weeks at Iron Ore Company of Canada Ltd. (IOC) and 17 weeks at Wabush Mines. By mid-November most of these problems had been resolved and Canada's mining resumed normal operating status.

In 1969, metallic minerals with a total value of $2,146 million accounted for 49.5 percent of Canada's mineral production. Nonmetallic mineral products, including construction materials were valued at $837 million, or 19.3 percent, and mineral fuels contributed $1,352 million or 31.2 percent of the total. Although the value of metallics produced in 1969 was down 6.9 percent, nonmetallic and fuel minerals recorded annual gains of 1.7 and 8.9 percent respectively.

Of the more than 60 mineral commodities regularly produced in Canada, about a dozen account for 80 to 85 percent of the national output. In 1969 the leaders, arranged in order of value were: Crude petroleum, $934.4 million; copper, $531.1 million; nickel, $446.2 million; natural gas (including sulfur and liquid byproducts) $427.5 million; iron ore, $399.5 million; zinc, $337.1 million; precious metals (gold, silver, and platinum) $188.7 million; asbestos, $182.0 million; cement, $158.5 million; sand and gravel, $120.8 million; and lead, $88.2 million.

Although comparative 1969 data are not available for all countries, Canada probably retained its position as the world's leading mineral producer on a value per capita basis. In dollar value of indigenous minerals, only the United States and the U.S.S.R. produced more. For individual commodities, Canada ranks first in asbestos, nickel, and zinc; second in gypsum, columbium-tantalum, lead, molybdenum, potash, silver, and titanium minerals; and among the top four world producers for more than a dozen other metals and minerals.

As in previous years though by an unusually small margin in 1969, Ontario retained its position as Canada's leading mineral Province, accounting for $1,123.4 million (25.9 percent) of the national value total. Alberta's contribution amounted to $1,103.8 million (25.5 percent), virtually all from oil and gas wells. Quebec, British Columbia, and Saskatchewan supplied 15.4, 9.0, and 7.4 percent, respectively. Manitoba and Newfoundland each accounted for about 5 percent, and Nova Scotia, New Brunswick, Prince Edward Island, and the Territories a total of 6.6 percent.

According to Dominion Bureau of Statistics estimates, the national index of mineral industry production in 1969 was 149.9, compared with the all industry index of 167.8 (both with respect to 1961 = 100 base). The value of mineral production represented 6.0 percent of the gross national product estimated at $72,242 million in 1969, thus maintaining the average ratio of the previous 2 years. General wholesale prices for mineral product categories in

[1] Mining engineer, Bureau of Mines, Washington, D.C.

[2] Where necessary values have been converted from Canadian dollars (Can$) to U.S. dollars at the rate of Can$1.00=US$0.925.

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1969 and 1968 (the latter in parentheses) related to the 1935–39 base period were as follows: nonferrous metals 264.0 (250.8); iron products 285.8 (276.8); nonmetallic minerals 210.0 (206.0); and chemical products 219.7 (213.7). The average hourly earning of mine employees was $3.25 in December 1969, compared with $2.98 and $2.75 for the same month of 1968 and 1967. Profits, before taxes reported by mining, quarrying, and petroleum companies totaled $565 million in 1969 ($572 million in 1968). The Department of Energy, Mines and Resources has estimated capital and repair, expenditures by the minerals industry in 1969 at $1,568.7 million, compared with $1,472.3 million in 1968. Capital investment by the petroleum and gas industries in 1969 amounted to $560.5 million. The metal industries reported capital expenditures, including those for new metallurgical facilities, of $448.2 million.

Exploration and new development activities continued at a normal rate in 1969 despite an uncertain economic outlook and announcement of proposed new national legislation that is regarded as threatening to the future of the Canadian mining industry. Long-term exploration projects of the larger companies and government field teams have continued. Several new areas have been opened.

Exploration and development activity during 1969 has been largely confined to silver, uranium, and petroleum prospects. Search for silver was centered in and adjacent to the established producing areas of Ontario and British Columbia. Despite marketing problems that confront existing producers, interest in uranium prospects, with considerable foreign participation (United States, Japanese, French, West German, and Italian) was relatively widespread and lively. Of the more than 200 exploration permits issued since January 1970 by the Atomic Energy Control Board, 80 permits were granted in 1969 to companies engaged in the search for uranium. The Elliot Lake and Agnew Lake areas in Ontario are credited with nost of the uranium drilling activity. In Quebec, investigations continued in the Lac Forestier-Ste-Anne-du-Lac area, in Huddersfield and Portland Townships, and at Grindstone Lake, northeast of Temiskaming. Discovery of the Rabbit Lake pitchblende ore body by Gulf Minerals Company, near Wollaston Lake in northern Saskatchewan, generated a staking rush early in 1969. In October, two uranium discoveries were announced at Baker Lake in the Northwest Territories. And in Labrador, discovery of pitchblende was reported by British Newfoundland Exploration Ltd. (with West German partners) at Inda and Witch Lakes.

The most spectacular mine developments of 1969 were in western Canada. Anvil Mining Corporation Ltd., in central Yukon, started shipment of lead, zinc, silver concentrates from Skagway, Alaska, in December. The company has contracts for delivery of more than 400,000 tons of concentrates annually, over a period of 8 years, to Japan and West Germany. And in the southern British Columbia-Alberta border area, six large coal companies are preparing mines, and erecting plants, townsites, and transportation facilities to export 165 million tons of coking coal over the next 15 years. The value of existing coal contracts with Japanese steel companies is estimated at Can$2.5 billion.

Geophysical studies and exploratory drilling for oil and gas were maintained at a high level in both inland and offshore areas. Emphasis during 1969 has been in the established regions of Alberta and Saskatchewan, the Arctic Islands, the Mackenzie River Delta, in Hudson Bay and off the coast of Nova Scotia.

Among legislative highlights of 1969 was the Ontario announcement (Bill 160) in April, requiring ores and concentrates produced in mines of the Province to be processed in Canada. Despite assurances that the regulation would be applied in a manner designed to avoid undue hardship, the law has generated considerable controversy. By yearend more than 30 mining companies had applied for exemption. And early in November, a "White Paper," proposing major revisions in national tax policies was presented to the House of Commons by Finance Minister E. J. Benson. While regarded as less restrictive than the Carter Commission proposals of 1967, the mining industry rejected provisions that would terminate (1) the 3-year tax exemption for new mines; (2) most of the established depletion allowances; (3) exemption from tax previously granted to prospectors and their backers, upon sale of mine property; and (4) depletion allowance previously

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granted to shareholders on dividends and royalties.

An updated summary of Federal legislation applicable to mining and oil and gas activities in Canada was published in October.[3]

PRODUCTION

Canada's mineral production in 1969 included 62 basic commodities (exclusive of refined aluminum and several minor elements), consisting of 27 metallics, 31 nonmetallic and construction materials, and four fuel minerals. Despite labor troubles that resulted in reduced output in many commodities, particularly metals, approximately half of the commodities recorded annual increases in 1969 and the total value of minerals produced was within 1 percent of the record set in 1968.

[3] Hodgson, E. C., and W. J. Beard. Summary Review Federal Taxation and Legislation Affecting the Canadian Mineral Industry, Dept. of Energy, Mines and Resources (Ottawa), Min. Res. Branch. Min. Inf. Bull. MR 101, 1969, 40 pp.

Table 1.—Canada: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Aluminum	884,904	887,862	996,162
Antimony [1]	575	526	884
Arsenic, white	343	313	318
Bismuth [2]	303	294	327
Cadmium [3]	2,194	2,275	1,981
Calcium, kilograms	246,614	212,513	402,953
Cobalt [4]	1,635	1,828	1,453
Columbium concentrates (shipments) [5]	1,959	1,979	2,731
Copper:			
Mine, recoverable	r 556,389	574,532	500,247
Smelter, refined	r 453,453	476,232	408,827
Gold, thousand troy ounces	2,962	2,688	2,434
Iron and steel:			
Iron ore, thousand tons	88,390	48,205	40,648
Pig iron and ferroalloys, do	6,449	7,756	6,954
Steel ingots and castings, do	8,795	10,207	9,350
Rolled steel, do	8,408	8,559	7,642
Lead:			
Mine, ore and concentrates, content	308,172	326,610	300,080
Refined, primary	176,732	183,342	169,773
Magnesium	8,062	9,007	9,603
Mercury [6], 76-pound flasks	---	5,000	20,000
Molybdenum	9,696	10,189	13,740
Nickel [7]	r 225,569	239,082	192,699
Platinum-group metals, troy ounces	401,263	485,891	266,100
Selenium, kilograms	328,661	288,262	322,331
Silver, thousand troy ounces	37,206	45,389	41,929
Tellurium, kilograms	33,212	32,201	47,072
Thorium (ThO_2), do	53,244	63,136	13,161
Tin, mine, long tons	195	160	120
Titanium slag (70–72 percent TiO_2)	546,539	610,415	679,737
Tungsten concentrates (W content)	r 100	1,295	1,440
Uranium (U_3O_8)	3,391	3,357	3,497
Yttrium (Y_2O_3), kilograms	78,268	51,406	39,067
Zinc:			
Mine, ore and concentrates, content	1,133,054	1,155,084	1,194,234
Refined, primary	r 367,743	387,307	423,066
NONMETALS			
Asbestos, thousand tons	1,317	1,448	1,448
Barite	156,281	125,245	128,269
Cement [8], thousand tons	7,253	7,408	7,751
Clays and products [9], value, thousands	$41,030	$45,067	$47,171
Diatomite	NA	473	442
Feldspar (shipments)	9,429	9,634	10,653
Fluorspar [6]	r 66,000	95,000	100,000
Gypsum and anhydrite, thousand tons	4,695	5,377	6,234
Lime, do	1,291	1,306	1,559
Lithium concentrate (LiO_2) [6]	r 198	---	---
Magnesite and brucite, value, thousands	$3,252	$2,818	$2,775
Nepheline syenite	364,326	387,001	456,217
Potash (shipments, K_2O equivalent)	2,162,051	2,646,813	2,854,149
Pyrite and pyrrhotite	342,862	285,035	293,418

See footnotes at end of table.

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Table 1.—Canada: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
NONMETALS—Continued				
Salt	thousand tons	4,864	4,413	3,853
Sand and gravel	do	190,205	186,186	185,120
Sodium sulfate		388,562	417,005	307,068
Stone [9]	thousand tons	73,152	68,891	63,566
Sulfur [10]		r 2,969,776	3,003,005	3,354,264
Talc, soapstone and pyrophyllite (shipments)		55,084	73,109	73,869
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Bituminous	thousand tons	8,516	7,945	7,849
Lignite	do	1,822	2,041	1,833
Coke, high-temperature	do	4,019	4,818	4,538
Fuel briquets	do	38	36	NA
Natural gas	million cubic feet	1,471,725	1,692,301	1,985,281
Peat	thousand tons	255	266	285
Petroleum:				
Crude	thousand 42-gallon barrels	351,287	379,896	407,499
Refinery products:				
Gasoline, total	do	141,967	149,736	156,655
Kerosine and jet fuels	do	27,562	28,174	31,619
Distillate fuel oil	do	106,230	114,412	118,208
Residual fuel oil	do	54,598	61,685	64,044
Lubricants	do	2,028	1,892	1,964
Other products	do	32,600	32,724	33,906
Refinery fuel and loss	do	25,390	27,328	27,563
Total	do	390,375	415,951	433,959

e Estimate. p Preliminary. r Revised. NA Not available.
[1] Antimony content of antimonial lead alloys, flue dust, and dore slag.
[2] Refined metal and bullion plus recoverable bismuth content of concentrates exported.
[3] Refined metal from domestic ores plus cadmium content of some exported ores and concentrates.
[4] All forms; excludes the cobalt in nickel sinter shipped to United Kingdom by International Nickel Co., but includes cobalt in Falconbridge nickel-copper matte to Norway.
[5] Refined nickel and nickel in produced oxide and recoverable nickel in matte exported.
[6] Cement shipped or used by producers.
[7] Value including bentonite and products from common, stoneware, fire clay, and other types of clay.
[8] Spodumene concentrates.
[9] Includes crushed, building, ornamental, paving, and similar uses.
[10] Includes sulfur from natural gas and from pyrite, pyrrhotite, and smelting of sulfide ores.

TRADE

According to preliminary estimates for 1969, Canada's total merchandise exports were valued at US$13.36 billion, and imports at $13.14 billion. Thus by a small margin, a favorable balance of trade was achieved, despite adversities experienced by the mining industry. The contribution of minerals to total exports fell to 26 percent in 1969, compared with 28 percent and 30 percent in 1968 and 1967, respectively. The $3.45 billion value of mineral and mineral product exports in 1969 comprised 77 percent of the industry's output. Exports of metallic materials were valued at $2.27 billion, fuel minerals at $713 million and nonmetallic and construction materials at $343 million. Principal export commodity items were crude petroleum, $486 million; aluminum, $429 million; copper, $370 million; nickel, $340 million; and iron ore, $308 million.

Imports of minerals and primary metal products in 1969 were valued at $1.56 billion, or about 12 percent of total merchandise imports. Metallic commodities were valued at $815 million; fuels $663 million; and nonmetallic materials, $79 million. According to value, principal items were crude petroleum, $364 million; rolled steel products including pipe and cable, $337 million; refined petroleum products, $179 million; coal and coke, $97 million; aluminum raw materials (bauxite and alumina), $91 million.

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Table 2.—Canada: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum:			
Alumina, Al content	11,458	13,630	United States 10,775.
Scrap	48,343	47,232	United States 31,163; Italy 11,104.
Pigs, ingots, wire bars, etc	690,049	782,568	United States 487,425; United Kingdom 121,324; Japan 92,510.
Bars, rods, sheets, castings	27,824	26,786	United States 15,256; New Zealand 3,790.
Foil	210	253	United States 206.
Fabricated materials, n.e.s	9,176	4,952	United States 2,310.
Cadmium	761	818	United Kingdom 504; United States 300.
Calcium metal kilograms	232,693	160,435	United States 146,782.
Cobalt:			
Metal	680	549	United States 368; Belgium-Luxembourg 122.
Oxides and salts, gross weight	877	747	United Kingdom 717.
Columbium concentrate [1] kilograms	404,098	134,211	All to United States.
Copper:			
Ore and matte, metal content	117,005	146,814	Japan 102,158; Norway 20,814.
Scrap, slag, sludge	28,215	61,368	West Germany 14,242; Belgium-Luxembourg 13,164; United States 11,975.
Refinery shapes	250,309	250,944	United States 121,787; United Kingdom 93,798.
Semimanufactures:			
Bars, rods, shapes, etc	22,391	35,181	United States 14,715; United Kingdom 3,839; Norway 3,698.
Pipe and tubing	9,434	12,383	United States 9,091; New Zealand 608.
Wire and cable	2,053	5,057	United States 3,619.
Iron and steel:			
Iron ore thousand tons	81,911	86,589	United States 27,115.
Pig iron do	441	498	United States 332; Japan 70.
Ferroalloys:			
Ferrochrome	---	1	All to United States.
Ferromanganese	3,936	924	United States 874.
Ferrosilicon	38,037	42,838	United Kingdom 23,385; United States 10,491; Japan 8,185.
Other, n.e.s	1,073	581	United States 255; West Germany 231.
Steel:			
Ingots and other primary forms thousand tons	160	271	United States 185; United Kingdom 52.
Hot and cold rolled products do	696	896	United States 661.
Pipe and tubes, iron and steel do	69	259	United States 248.
Lead:			
Ore and concentrate, metal content	114,481	130,501	United States 33,080; Japan 32,931; West Germany 26,746; Belgium-Luxembourg 25,499.
Pigs, blocks and shot	120,038	125,900	United States 49,014; United Kingdom 46,128.
Alloys, scrap, and metal, n.e.s	8,065	8,360	United States 7,084.
Magnesium [2]	5,883	6,840	United States 3,175; United Kingdom 2,703.
Mercury [1] 76-pound flasks	---	5,625	All to United States.
Molybdenum, ore and concentrate, content	10,792	10,299	United Kingdom 3,259; Japan 2,055; Netherlands 1,574.
Nickel:			
Ore, matte, and speiss, metal content	75,897	86,661	United Kingdom 42,506; Norway 37,633.
Scrap	1,826	3,744	United States 1,840; West Germany 1,124.
Oxide, metal content	31,030	38,155	United States 27,679; United Kingdom 5,757.
Ingots and other refined forms	116,718	115,299	United States 89,182; United Kingdom 19,219.
Fabricated products, n.e.s	4,028	3,538	United States 2,544.
Platinum-group metals:			
Concentrate, residues and matte, content troy ounces	457,098	569,416	United Kingdom 547,174.
Scrap do	26,397	32,041	Japan 10,975; United Kingdom 10,550; United States 10,516.
Metals do	18,757	15,526	United States 14,671.
Selenium metals and salts, selenium content kilograms	244,668	357,022	United States 230,606; United Kingdom 102,058.
Silver:			
Ore and concentrate, metal content thousand troy ounces	10,408	21,502	United States 12,139; Japan 3,524; Belgium-Luxembourg 3,299.
Refined metal do	13,736	28,105	United States 25,966.

See footnotes at end of table.

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Table 2.—Canada: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS—Continued			
Tin, ore and concentrate, long tons	325	118	Mexico 105; United States 13.
Titanium slag, 70 percent TiO_2 [1]	133,552	182,265	All to United States.
Uranium concentrates, value, thousands	$22,083	$24,112	United Kingdom $24,109.
Zinc:			
Ore and concentrate, metal content	667,420	776,384	United States 331,553; Belgium-Luxembourg 189,055; Japan 89,513.
Blocks, pigs, slabs	270,025	289,126	United States 105,117; United Kingdom 89,757.
Alloys, scrap, dross, etc	7,458	5,677	United States 3,715; Belgium-Luxembourg 1,137.
Fabricated materials, n.e.s	3,249	6,005	United States 5,338.
NONMETALS			
Abrasives:			
Fused alumina, crude and grains	151,664	143,895	United States 134,062.
Silicon carbide, crude and grains	79,076	93,372	United States 92,936.
Asbestos:			
Crude	208	183	Japan 81; United States 81; West Germany 19.
Milled fiber, all grades, thousand tons	1,217	1,324	United States 600.
Barite, crude	132,542	105,679	United States 100,369.
Cement, portland	297,573	332,490	United States 331,937.
Clay and clay products, value, thousands	$9,891	$8,418	United States $6,302.
Gypsum, crude, thousand tons	3,535	4,049	All to United States.
Lime	81,760	77,350	United States 76,550.
Limestone, crude, crushed and refuse	1,286,152	1,548,482	All to United States.
Nepheline syenite	279,062	293,186	United States 262,978.
Potash materials [1]	r2,298,531	2,911,269	All to United States.
Salt, value, thousands	$5,482	$5,477	United States $5,382.
Sand and gravel	545,598	450,440	United States 450,172.
Silica, quartzite	50,984	58,138	All to United States.
Sodium sulfate	112,339	98,869	United States 94,486.
Stone, rough building and crude n.e.s	91,257	245,981	Mainly to United States.
Sulfur, crude and refined	1,609,048	1,915,190	United States 834,296; Australia 293,678; India 222,636.
Talc and soapstone [1]	4,533	10,037	All to United States.
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous	1,214,127	1,312,708	Japan 1,155,048; United States 156,076.
Briquets, coal and coke	24,416	23,009	All to United States.
Coke, all types	76,143	138,080	United States 119,791; Japan 18,289.
Natural gas, million cubic feet	505,165	607,355	All to United States.
Petroleum:			
Crude, thousand 42-gallon barrels	150,345	167,488	All to United States.
Refined products:			
Gasoline, total, do	426	412	United States 405.
Distillate fuel oil, do	1,415	2,651	United States 2,136; St. Pierre-Miquelon 361.
Residual fuel oil, do	2,081	2,231	All to United States.
Lubricants, do	45	27	United States 20; St. Pierre-Miquelon 4.
Liquefied gases, do	12,403	13,488	United States 11,265; Japan 2,220.
Other petroleum and coal products, n.e.s., value, thousands	$2,727	$4,660	United States $4,189.

• Estimate. r Revised.
[1] Data given are from U.S. Department of Commerce Import Statistics.

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Table 3.—Canada: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum:			
Bauxite	2,323,582	2,277,397	Guyana 1,599,867; Surinam 606,885.
Alumina	690,126	771,552	Jamaica 374,643; United States 186,105; Guyana 110,900.
Scrap aluminum and alloys	8,659	14,772	Mainly from United States.
Pigs, ingots, shot, slabs, etc	7,418	13,647	United States 9,868; Norway 1,990.
Semimanufactured products	75,201	82,097	United States 71,699.
Pipe, tubes, wire, cable	1,159	1,181	United States 1,080.
Manufactured materials value, thousands	$8,483	$6,208	United States $5,137.
Antimony, oxide and salts, metal content	241	360	United Kingdom 300; United States 39.
Chromium ore and concentrate, metal content	31,285	20,323	United States 8,789; Philippines 3,719; Republic of South Africa 3,471.
Copper:			
Ore, concentrate and scrap, copper content	31,589	62,328	United States 61,915.
Blocks, pigs, ingots	4,817	5,284	All from United States.
Bars, rods, sheets, tubes, etc	1,399	1,561	United States 1,050; United Kingdom 273.
Wire	194	81	Mainly from United States.
Oxide and sulfate	599	523	United States 252; Japan 180; United Kingdom 68.
Alloys, primary and semimanufactured forms	4,793	5,014	United States 3,264; United Kingdom 1,155.
Iron and steel:			
Iron ore, thousand tons	2,439	2,794	United States 2,335; Brazil 379.
Scrap iron and steel	511,352	581,694	Mainly from United States.
Pig iron	26,075	33,364	U.S.S.R. 17,011; United States 9,957; Finland 6,375.
Ferroalloys:			
Ferrochrome	19,722	13,649	Republic of South Africa 10,601; United States 1,968.
Ferromanganese	14,555	25,348	Republic of South Africa 24,048.
Silicomanganese	3,812	1,219	Yugoslavia 508; U.S.S.R. 496; United States 181.
Ferrosilicon	5,265	8,905	United States 7,941; Norway 962.
Ferrotungsten	87	54	Portugal 33; United Kingdom 21.
Ferrovanadium	352	240	United States 96; Austria 54; Sweden 40.
Other	3,219	4,084	United States 3,244; Norway 632.
Steel ingots and equivalent primary forms	29,659	8,785	United Kingdom 3,524; United States 3,189; West Germany 1,803.
Iron and steel products:			
Castings and forgings	80,481	113,282	United States 103,234.
Rolled steel, including structurals and rails	1,034,726	973,411	United States 240,053; Belgium-Luxembourg 159,772; West Germany 147,525; Japan 124,968; United Kingdom 108,414.
Pipe, tubes, wire and cable	259,110	234,475	United States 72,079; Japan 66,870; United Kingdom 46,743.
Lead:			
Primary and fabricated forms	674	499	United States 367; United Kingdom 104.
Oxide	2,214	2,389	Mexico 1,543; United States 540; United Kingdom 306.
Manganese:			
Ore and concentrate, manganese content	74,987	62,786	Ghana 14,793; Congo (Kinshasa) 10,729; Brazil 10,196.
Metallic manganese	2,018	2,969	Republic of South Africa 1,926; United States 561; Japan 469.
Magnesium metal	1,354	2,180	United States 1,174; West Germany 506; U.S.S.R. 500.
Mercury, 76-pound flasks	4,688	2,604	Yugoslavia 918; United States 782; Spain 400.
Molybdenum, molybdic oxide, gross weight	205	617	All from United States.
Nickel, unwrought and semimanufactured, including alloys	11,817	13,650	Norway 10,329; United States 2,587.
Platinum-group metals, troy ounces	212,889	207,961	United Kingdom 198,626.
Silver, thousand troy ounces	5,384	14,061	United States 13,403.
Sodium metal	7,717	7,971	Mainly from United States.
Tin, blocks, pigs and bars, long tons	4,548	4,301	Malaysia 3,031; United States 925.
Titanium:			
Dioxide, pure and extended	10,323	10,913	United States 9,660; United Kingdom 779.
Metallic titanium	1,966	211	United States 166; United Kingdom 27.
Tungsten, in ore and concentrate	106	60	United States 29; South Korea 16; United Kingdom 15.

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Table 3.—Canada: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS—Continued			
Zinc:			
Pigs, slabs, blocks, anodes	966	1,377	All from United States.
Bars, plates, sheets, discs, shells	724	663	United States 529.
Fabricated materials	670	525	United States 501.
Dust and granules	1,099	963	All from United States.
NONMETALS			
Barite, ground	5,374	7,168	United States 7,113.
Bentonite, clay and drilling mud	199,455	279,140	United States 265,532.
Cement, all types	40,023	46,721	United States 20,036; United Kingdom 13,128; Belgium-Luxembourg 6,155.
Clays, ground or unground	290,439	262,642	United States 214,475; United Kingdom 48,131.
Cryolite, natural	2,795	4,117	Denmark 3,797.
Diamonds:			
Unset, thousand carats	73	80	Belgium-Luxembourg 35; Israel 26.
Industrial, do	1,089	1,070	United States 769; United Kingdom 114.
Dust, do	295	344	United States 334.
Diatomaceous earth	30,235	27,832	All from United States.
Fluorspar	85,497	104,748	Mexico 88,558.
Fuller's earth	8,236	8,210	All from United States.
Gypsum, crude	62,697	62,662	Mexico 61,658.
Lime	20,061	22,471	United States 22,399.
Magnesium compounds:			
Dolomite, calcined	9,467	8,987	All from United States.
Magnesia, dead burned	34,693	38,485	United States 32,387; Yugoslavia 4,793.
Mica, unmanufactured	3,168	2,980	United States 2,968.
Phosphate rock, thousand tons	2,068	2,132	United States 2,128.
Phosphate fertilizers	149,345	40,461	All from United States.
Potash products, fertilizers	143,582	62,620	United States 49,136; West Germany 12,484.
Salt and brine	514,385	584,866	United States 254,891; Mexico 195,750; Bahamas 92,388.
Sand and gravel, thousand tons	687	620	All from United States.
Silica sand, do	864	1,004	United States 1,002.
Sodium sulfate and Glauber's salt	25,057	22,697	United States 20,962.
Stone:			
Crushed, including stone refuse, thousand tons	1,185	1,252	United States 1,248.
Cut (granite, marble, slate and other)	28,680	28,876	United States 19,014; Republic of South Africa 4,650.
Sulfur, elemental	113,199	68,778	All from United States.
Talc and soapstone	24,024	25,623	United States 25,097.
Vermiculite, crude	26,618	25,037	United States 22,608.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bituminous materials, crude, value, thousands	$348	$387	United States $263; United Kingdom $108.
Coal:			
Anthracite, thousand tons	477	390	United States 380.
Bituminous and subbituminous, do	14,142	15,074	All from United States.
Briquets, coal and coke	7,701	5,499	Do.
Coke, all types (except briquets), thousand tons	864	741	United States 686.
Natural gas, million cubic feet	52,872	88,228	All from United States.
Petroleum:			
Crude, thousand 42-gallon barrels	170,785	177,739	Venezuela 124,275; Iran 20,742; Saudi Arabia 18,606.
Refinery products:			
Gasoline, total, do	5,182	4,443	Netherlands Antilles 2,481.
Kerosine and jet fuel, do	7,910	10,946	Netherlands Antilles 4,968; Venezuela 4,684.
Distillate fuel oil, do	14,141	19,840	Venezuela 15,223; Netherlands Antilles 3,468.
Residual fuel oil, do	37,110	32,291	Venezuela 14,308; Netherlands Antilles 9,164; United States 6,751.
Lubricants, do	1,671	1,705	United States 1,568.
Liquefied petroleum gases, do	281	411	United States 365.
Other refinery products, do	617	646	United States 416; Panama 131; United Kingdom 65.
Other petroleum and coal products, value, thousands	$8,531	$6,929	United States $5,805; United Kingdom $1,098.

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COMMODITY REVIEW

METALS

Aluminum.—Production of primary aluminum was at a record level throughout 1969. Combined output of Canada's six reduction plants, all operating at capacity, was more than 12 percent above the previous peak established in 1968. Aluminum Company of Canada Ltd., principal component of the Alcan Aluminium Limited[4] international industrial empire, reported production of 878,790 metric tons in the company's five smelters (at Alma, Arvida, Beauharnois, and Shawinigan in Quebec and at Kitimat on the British Columbia coast). Alcan subsidiaries and affiliates in other countries accounted for 657,000 metric tons, also a record, achieved in part through the opening during the year of new smelters in Australia, India, and Japan. The fully integrated array of Alcan companies, including raw material sources, alumina plants, smelters, and fabricating facilities embraces six continents and 34 countries.

The Canadian British Aluminium Company Ltd. (CBA) smelter at Baie Comeau, Quebec, which accounts for the balance of Canadian primary aluminum, was recently acquired by Reynolds Metals Co. (83.5 percent). Completion of expansion, started in 1968, is expected to raise the annual capacity of this smelter from 104,000 to about 160,000 tons early in 1970.

Consumption of new aluminum by domestic fabricators has been estimated at 204,000 tons in 1969. Exports of primary and semifabricated forms totaled 821,575 tons, mostly to the United States, Japan, United Kingdom, Republic of South Africa, and West Germany.

Columbium and Tantalum.—Production of columbium pentoxide (Cb_2O_5) in pyrochlore concentrates by St. Lawrence Columbium and Metals Corporation near Oka, Quebec, amounted to 1,365 metric tons in 1969, compared with 953 tons in 1968. A favorable market outlook and expanded mill capacity completed late in the year justify anticipated output on the order of 2,000 metric tons Cb_2O_5 in 1970. The bulk of production has been exported in concentrates to Europe and United States. In 1969 U.S. imports from Canada amounted to 417 metric tons.

Tantalum Mining Corporation of Canada Ltd., at Bernic Lake, Manitoba, began shipment of tantalite concentrates from Canada's first commercial tantalum mine in August. While full production details are not available, recovery of Ta_2O_5 in the final quarter of the year was reportedly in excess of 45,000 kilograms. Capacity of the plant is 450 tons of ore per day. In addition to tantalum, arrangements are being made to recover cesium, beryllium, and lithium components of the ore.

Copper.—Strikes extending through the summer and fall at several of Canada's largest copper producers, including the Ontario mines and metallurgical works of Inco and Falconbridge Nickel Mines Ltd., resulted in 13 percent lower mine output and 14 percent less refined copper than was produced in 1968. Supplies of refined copper became critical for domestic consumers during the second half of the year and the price, reflecting both local and worldwide shortages, rose from Can$0.45 per pound in January to Can$0.57 for the September-December period.

Although a few small operations were suspended in 1969, their output was more than offset by new developments reported during the year. More than 100 mines account for Canada's current copper production, and about 30 others are being explored and developed for future production. All Provinces and Territories, with the exception of Alberta and Prince Edward Island, contributed to Canada's mine production of copper in 1969. Thirty-five mines in Ontario, including 12 operated by Inco and eight by Falconbridge, reported a total mine output of 207,695 tons, or 41 percent of the national total. Quebec's 24 mines, most of which ship to the Noranda and Murdochville smelters, accounted for 28 percent. The 10 copper producers in British Columbia, which collectively accounted for nearly 15 percent, export their entire output to Japan and the United States in the form of ores and concentrates.

Copper metallurgical facilities in Canada number six smelters (at Murdochville and Noranda, Quebec; at Coniston, Copper

[4] Canadian company, based in Montreal, Quebec, and owned 54 percent by residents of the United States and 36 percent by Canadians.

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Cliff, and Falconbridge in Ontario; and at Flin Flon on the Manitoba-Saskatchewan border). All of Canada's refined copper, amounting to 408,827 metric tons in 1969, was recovered by Canadian Copper Refiners Ltd., near Montreal, Quebec, and Inco near Sudbury, Ontario.

Shipments of refined copper to domestic consumers totaled 218,000 metric tons in 1969, compared with 229,700 in 1968. According to 1967 data, percentage distribution by consuming industries was copper sheet, strip, bars, pipe, tube, etc, 34 percent; wire and rod mill products, 56 percent; brass mill products, 9 percent; and miscellaneous, 1 percent.

Exports of copper, including contents of ore and concentrates, scrap, unwrought metal, and semimanufactures totaled 406,000 metric tons in 1969. The corresponding figure for 1968 was 512,000 tons. Principal export items in 1969 were 99,000 tons in ore and concentrates to Japan; 96,000 tons of refinery shapes and semimanufactured products to the United States; and 75,000 tons in metal forms to the United Kingdom.

Gold.—Continuing the trend of the 1960's, the number of producers and total output of gold declined in 1969. At year-end 32 lode gold mines were in operation: Nine in Quebec, 17 in Ontario, five in the Northwest Territories, and one in British Columbia. These mines were credited with 80.6 percent of Canada's gold production in 1969. Byproduct recovery from base metal operations (including those affected by strikes during the year) amounted to 19.1 percent, and placer mines, mostly in Yukon Territory, added 0.3 percent.

All but three of Canada's gold mines were eligible for Federal assistance under the Gold Mining Assistance Act (EGMA). According to the report on administration of this Act for the year ending March 31, 1969, assistance payable to 31 mines during the fiscal period amounted to Can$12,926,392; equivalent to Can$8.16 per ounce produced. Twenty mines received Can$10.27 per ounce, the maximum payable under the Act.

Since its enactment in 1948, the number of mines receiving assistance has fallen from about 120 to 31. Total payments, through March 1969, amount to Can$261 million.

The Royal Canadian Mint price paid to producers averaged Can$37.69 per ounce through 1969. The three mines that elected to sell on the London Gold Market, thus forfeiting EGMA benefits, received prices that ranged from US$43.83 per ounce in March to $35 in December.

Iron Ore, Pig Iron, and Steel.—Seriously affected by the labor strikes at mines in Quebec-Labrador (Newfoundland) and Ontario, 1969 production of iron ore (including concentrates and pellets) was 7.6 million tons below the record output of over 48 million tons in 1968. Canada's largest producer, IOC mines at Schefferville, Quebec, and the concentrator and pellet plant at Labrador City, Newfoundland, were shut down for 15 weeks. Wabush Mines' operations in Labrador and ore processing plants at Pointe Noire, Quebec, were down 17 weeks, and the Quebec Cartier Mining Company mine and concentrator at Gagnow, Quebec, were closed for 7 weeks. In Ontario, labor problems also caused shutdowns for periods of 7 to 18 weeks at Caland Ore Co. Ltd., Algoma Ore Properties, and the byproduct operations of Inco and Falconbridge Nickel Mines Ltd.

Annual production capacity remained static, at 48 million tons, including 26.5 million tons of pellet capacity, throughout the year. Aside from relatively small increases anticipated for the byproduct recovery from nickel-copper ores in Ontario, no further mine production expansion is expected in 1970 or 1971. However, future changes in the export pattern for iron raw materials are indicated. In past years virtually all exports from mines in eastern Canada have been to United States and Europe, with 1.5 to 1.9 million tons per year from the west coast to Japan. In 1969, IOC initiated shipments of pellets from Sept Isles, Quebec, to Japanese steelmakers. IOC has contracted to ship about 1 million tons in 1970–71, and Quebec Cartier Mining Co. has contracted to ship 1.2 million tons per year for 5 years beginning in 1971. These two companies have undertaken expansion of port facilities to permit loading supercarriers of 200,000 tons at Sept Isles and 150,000 tons at Port Cartier.

Closures due to strikes of 11 and 13 weeks, respectively, at the Hamilton works of The Steel Company of Canada Ltd.

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(STELCO) and Sault Ste. Marie works of Algoma Steel Corp. Ltd. resulted in annual declines of 802,000 tons of pig iron and 857,000 tons of steel in 1969. Quantities of raw materials used and output of the Canadian iron and steel industry in 1969, compared with the two preceding years, are summarized in table 4.

Table 4.—Salient iron and steel statistics

(Thousand metric tons)

	1967	1968	1969
Blast furnace feed:			
Iron ore:			
From Canadian mines	899	280	274
Imported	672	637	456
Sinter, pellets, etc.:			
From Canadian mines	4,717	7,858	6,546
Imported	2,097	1,657	1,467
Made in iron and steel plants	1,844	1,223	806
Blast furnace output:			
Pig iron	6,296	7,605	6,769
Ferroalloys	152	151	185
Steel furnace feed:			
Pig iron	5,529	6,695	5,712
Scrap	4,507	4,874	4,658
Steel furnace output:			
Ingots	8,665	10,078	9,210
Castings	130	129	140
Total	8,795	10,207	9,350
Rolled steel products:			
Carbon steel:			
Hot rolled	5,690	5,923	5,287
Cold rolled and coated	2,355	2,240	2,007
Alloy steel	363	396	348
Total	8,408	8,559	7,642

Plans to invest about $140 million on plant modernization and expansion projects in 1969 fell short of that amount due to delays caused by labor troubles in both construction and steel industries. By the end of the year work on most of these projects had been resumed and several new projects added. Dominion Foundries & Steel Ltd. in 1969 started a $55 million program in its Hamilton, Ontario, works that will provide a fourth blast furnace and raise crude steel capacity by 35 percent. Also during the year, STELCO announced plans involving investment of over $90 million that will replace eight open hearths with three 120-ton basic oxygen furnaces and raise annual raw steel capacity from 4.3 to 5.4 million tons at the Hilton Works in Hamilton. Aside from the announced plans of the fully integrated companies, several of the small steel mills are considering or have embarked on programs to increase capacity or expand variety or size range of products.

Demand for both raw steel and rolled products continued strong during the year. Shipments of rolled steel products to domestic consumers totaled 6.5 million tons in 1969, compared with 6.4 million in 1968. Canadian trade data for 1969 (1968 data in parentheses) show: Imports, pig iron, 20,814 (33,364) tons; steel ingots and castings, 273,204 (8,785) tons; rolled forms, including pipe, wire and similar products, 1,720,103 (1,207,886) tons. Exports, pig iron, 655,000 (498,000) tons; steel ingots and castings, 156,000 (271,000) tons; and rolled products, including pipe, 786,000 (1,155,000) tons. As in previous years, the great bulk of this trade was with United States.

Lead and Zinc.—In 1969 both mine output and production of refined lead were below the levels of the previous 2 years. Zinc, however, continued its uptrend and set new records for both mine and smelter production. According to Department of Energy, Mines and Resources lists, 28 companies contributed to the year's output of lead while 40 were credited with zinc. However, many of these produce both metals, usually with varying quantities of other metals such as gold, silver, and copper. Regional mine sources of lead and

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zinc (the latter in parentheses) in 1969 were as follows: Newfoundland and Nova Scotia, 7.5 (2.8) percent; New Brunswick, 17.9 (13.2) percent; Quebec, 0.4 (16.4) percent; Ontario, 4.0 (29.3) percent; Manitoba and Saskatchewan, 0.2 (6.5) percent; British Columbia, 32.6 (12.4) and the Territories, 37.4 (19.8) percent.

The drop in Canada's lead production in 1969 has been attributed mainly to the exhaustion of high-grade direct shipping ores at Cominco Ltd. mines at Pine Point in the Northwest Territories in December 1968. Production of refined lead from Canadian ores and concentrates by the Trail Smelter was 154,000 tons in 1969, compared with 173,000 in 1968. Lower lead output was also reported at the Brunswick Mining & Smelting Corp. Ltd. mines in New Brunswick. Western Nuclear Mines Ltd., at Hanson Lake in northern Saskatchewan, suspended operation in July. The major lead-zinc event of 1969 was the start of production and shipment of concentrates by Anvil Mining Corporation Ltd. from central Yukon. Under the joint backing of Cyprus Mines Corp. (United States) and Dynasty Exploration Ltd. (Canada), 60 and 40 percent, respectively, the $56 million Anvil program was initiated in 1967. The ore body, with reserves estimated at over 60 million tons, grading 9 to 10 percent combined lead and zinc, was developed as an open pit mine and equipped with a 5,000-ton-per-day concentrator. First shipments of concentrates in fullfillment of contracts with Japanese smelting companies, calling for about 340,000 tons annually for 8 years, were exported from Skagway, Alaska, in December. From the Anvil mill to Skagway concentrates are hauled 237 miles by truck to Whitehorse, thence 110 miles by rail to the port. Early in 1969 a $3.5 million expansion plan was announced to accommodate a new contract with a West German firm for 85,000 tons of concentrate per year over 8 years beginning in 1970.

In compliance with recent Ontario legislation requiring domestic processing, Ecstall Mining Ltd. announced its decision to proceed with construction of an electrolytic zinc refinery adjacent to the Kidd Creek concentator at Hoyle, Ontario. The new plant will be designed for annual output of 110,000 tons of slab zinc, 210,000 tons sulfuric acid, and 450 tons of cadmium metal, and is scheduled for completion in 1972.

Domestic consumption of primary, refined lead in 1969 was estimated at 67,850 metric tons. Shipments of zinc to Canadian consumers totaled 111,000 tons. Exports of lead in 1969 included 127,165 tons in concentrates, of which 56,000 tons went to United States and 34,000 to Japan; and 97,150 tons in refined forms, of which 41,361 tons went to United States and 38,322 tons to United Kingdom. Zinc exports, totaled about 1,010,000 tons including 347,612 tons in concentrates and 133,978 in primary forms to United States. About 250,000 tons in ores and concentrates and 80,000 tons of primary metal went to United Kingdom and other European countries.

Mercury.—In its first full year of operation, Canada's sole mercury producer, the Cominco Ltd. Pinchi Lake mine in British Columbia treated 337,000 tons of ore and recovered about 20,000 flasks (76 pounds each). The great bulk of this output was marketed in United States, as indicated by U.S. reported imports of 15,546 flasks during 1969.

A second Canadian producer, Silverquick Development Company (B.C.) Ltd., with a mine and a recently completed 500-ton-per-day mill at Haney in southwestern British Columbia, expects to start production early in 1970. When in full-scale operation, an output of 3,000 flasks annually is anticipated. Ore reserves reportedly contain over 400,000 tons proven and 1.4 million inferred, with an average content of 2 pounds mercury per ton.

Molybdenum.—Since 1963, when Molybdenite Corporation of Canada Ltd., near Val d'Or, Quebec, accounted for Canada's entire molybdenum output toaling 378 metric tons, the rise to a record 13,740 tons by eight companies in 1970 is little short of phenomenal. Two of the newcomers, Preissac Molybdenite Mines Ltd. and Cadillac Moly Mines Ltd., are situated in the Val d'Or district where molybdenite (MoS_2) is mined as the principal product. The great growth in production has resulted from opening of four new molybdenite mines in British Columbia and coproduction of molybdenum with copper at Murdochville on the Gaspé Peninsula, Quebec.

In 1969, Endako Mines Ltd., in north-

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central British Columbia, reported production of 8,530 metric tons of molybdenum in molybdenite concentrates and molybdic oxide. British Columbia Molybdenum Ltd. at Alice Arm produced 2,526 tons in concentrates; Brynnor Mines Ltd., central British Columbia, reported 1,062 tons in concentrates; and Red Mountain Mines Ltd., near Rossland, accounted for 272 tons in concentrates. Byproduct recovery of molybdenum in concentrates by the two mines of Gaspé Copper Mines Ltd. (Needle Mountain and Copper Mountain) in Quebec totaled 1,230 tons.

Construction of the 22,000-ton-per-day mill and preparation of the open pit mine continued through 1969 at Brenda Mines Ltd. in the Okanagan Lake vicinity of southern British Columbia. The Brenda ore body has been estimated at over 160 million tons averaging 0.18 percent copper and 0.05 percent molybdenum. Beginning in 1970 this venture is expected to recover 2,500 to 3,000 tons of molybdenum annually. And, by 1972, Lornex Mining Corporation Ltd., with a 35,000-ton-per-day plant in Highland Valley, southwestern British Columbia, is due to come on stream with an additional 1,150 tons annually, also from bimetal ores. The Lornex ore reserve is estimated at 266 million tons grading 0.43 percent copper and 0.014 percent molybdenum. In addition to these, six well-established companies are conducting exploration and feasibility studies on molybdenum and copper-molybdenum deposits in other parts of British Columbia.

Confronted by adequate indigenous supplies in the Western States virtually no Canadian molybdenum comes to the United States. Adhering to the pattern of recent years, exports in 1969 totaling 11,645 metric tons of molybdenum in concentrates and other forms went to the United Kingdom (3,403 tons), France (1,723 tons), Japan (1,671 tons), the Netherlands (1,580 tons), and 14 other countries (3,268 tons).

Nickel.—Under the impact of strikes that closed the plants of Inco and Falconbridge Nickel Mines Ltd., from July 10 and August 21 respectively, to late November, Canadian production of nickel fell to a 10-year low. Despite its poor annual showing, the nickel industry has maintained its dynamic strength. By yearend, work on virtually all continuing development and expansion projects had been resumed, and both Inco and Falconbridge had announced new plans to increase production.

The output of 20 nickel-copper mines in Ontario accounted for 69 percent of Canada's nickel production in 1969. With the exception of the Consolidated Canadian Faraday Ltd. mine at Werner Lake, near the Manitoba border, all Ontario's production was from the Sudbury District where Inco operates 11 and Falconbridge eight mines. Manitoba contributed 30.3 percent of the national total, with production dominated by Inco's Thompson and Birchtree mines at Thompson. About one-third of the Provincial total is from the Sherritt Gordon Mines Ltd. mine at Lynn Lake. In September, Dumbarton Mines Ltd. started shipments of ore from Bird River, Manitoba, to the Consolidated Canadian Faraday Ltd. mill in Ontario. The relatively small British Columbia output was all from Giant Mines Ltd., at Hope, for export to Japan. Following closure of two small mines in Quebec, in 1968, production was maintained in that Province by the start of shipments of nickel concentrates to the Falconbridge smelter from Renzy Mines Ltd. in Hainault Township, about 110 miles north of Ottawa.

The three integrated nickel producers reported deliveries totaling 220,279 metric tons of refined nickel in 1969. Company annual statements give annual production data and consolidated ore reserve status at yearend 1968 and 1969 as follows:

	1968	1969
Nickel production (deliveries), in metric tons:		
Inco	r 218,087	173,363
Falconbridge	32,074	36,581
Sherritt Gordon [1]	r 11,400	10,335
Ore reserves, in million metric tons:		
Inco	336.5	344.3
Falconbridge	r 83.1	84.2
Sherritt Gordon	11.4	11.4

r Revised.
[1] Total production of nickel: 13,620 metric tons of which 3,157 were derived from toll materials, mostly from New Caledonia and Australia.

In addition to the eight new mines (six in Ontario and two in Manitoba) that Inco has under development and the new process refinery being built at Copper Cliff, Ontario, construction started in 1969 on the Clarabelle mill in Copper Cliff. Designed to treat 32,000 tons of ore per day, this will be Inco's fifth mill in the Sud-

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bury area. Work has also continued on erection of the world's highest (1,250-foot) smelter stack and on increasing capacity of the iron ore recovery plant. With completion of all current expansion, scheduled for the end of 1972, Inco's investment in these projects will total about $1 billion, and the company's annual nickel production will approach 275,000 metric tons.

Falconbridge Nickel Mines Ltd. continued development of two mines (Mainbridge and Bowden Lake) near Wabowden, 50 miles north of Lake Winnipeg in Manitoba. In Ontario, underground development activities have continued at the Lockerby property, Onaping, Fecunis Lake, and Strathcona mines. Of the nearly $30 million capital and preproduction expenditure in 1969, more than half was in connection with the new nickel-iron refinery. In response to the Ontario Government directive in 1969 requiring treatment of Ontario mine products in Canada, the company announced plans to provide a domestic nickel refinery to treat at least 51 percent of the company's Ontario output by the end of 1974. For many years, Falconbridge nickel has been exported as matte, for refining in the wholly owned refinery (Falconbridge Nikkelverk A/S) in Norway.

Canadian exports of nickel in semiprocessed and refined forms during 1969 amounted to 164,398 metric tons (202,000 tons in 1968). Trade statistics for the year report 69,831 tons of nickel in matte and other crude forms, mostly to Norway and the United Kingdom. Approximately 83 percent of the 94,567 tons of ingots and other refined forms went to the United States.

Platinum-Group Metals.—Since they are almost exclusively a byproduct of nickel-copper ores, Canadian output of platinum metals in 1969 was abnormally low, reflecting labor troubles that affected the nickel-copper producers. The platinum metals are initially extracted in the form of refinery sludges, residues, and nickel-copper matte. Accordingly mines in Ontario, Manitoba, Saskatchewan, and Quebec are regarded as the original source of platinum metals recovered by Inco and Falconbridge, although final separation of the metals is actually made in foreign precious metal plants.

Canadian trade statistics for 1969 report export of 434,000 ounces of platinum metals in concentrates, residues, and matte. The great bulk of this went to United Kingdom, with relatively small quantities to Norway and the United States.

Silver.—As a result of lower output at a few large producers in the Northwest Territories, British Columbia, and the Cobalt-Gowganda District of Ontario, Canadian silver production in 1969 was nearly 3.5 million ounces less than the national record 45.4 million ounces produced in 1968. Virtually all Canadian silver is produced in mines noted primarily for lead, zinc, copper, nickel, and gold. Mines worked primarily for silver exist in the Territories and in the Cobalt District of Ontario. With the single exception of Prince Edward Island, all of Canada's Provinces and Territories contributed to the national output. In 1969 Ontario was credited with 51 percent of the total. British Columbia accounted for 13 percent; New Brunswick and Quebec each for about 10 percent; and the Yukon and Northwest Territories, for 7 and 5 percent, respectively.

The Kidd Creek, Ontario, mine of Ecstall Mining Ltd., the world's largest silver mine, produced over 13.8 million ounces of silver in copper, lead, and zinc concentrates in 1969. The second largest Canadian source of silver was Cominco Ltd., which reported 5.7 million ounces from company mines and toll ores treated at the Trail Smelter in southern British Columbia.

According to 1968 data, 90.5 percent of the year's production was from base metal ores; 8.5 percent came from silver-cobalt mines (in Ontario); and 1.0 percent from lode and placer gold mines.

On the basis of 8 months' output reported by the industrial refineries and the Royal Canadian Mint, the 1969 total output of domestically refined silver is expected to total about 31 million ounces compared with 26.3 million reported in 1968. Assuming that domestic consumption remained at about the same level in both years, Canadian trade statistics reflect the substantial increase in refined silver supply. Exports totaled 34.7 million ounces (of which 96 percent went to the United States) in 1969 compared with 28.1 million ounces in 1968. In addition to the refined metal, Canada during 1969 exported 21.9 million ounces in ores and concentrates, most of which was consigned to mills and smelters in the United States.

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Domestic consumption of refined silver in 1968 totaled 13.6 million ounces. Percentage use distribution was as follows: coinage, 54.2; silver salts, 17.0; sterling, 6.2; alloys, 5.6; and sheet, foil, and miscellaneous, 17.0.

Uranium.—Four producers, three in the Elliot Lake region of Ontario and the fourth at Uranium City, Saskatchewan, continued operation through 1969 and accounted for the year's output of 3,500 tons uranium oxide (U_3O_8). This represented a small increase over annual production of the past few years but remains insignificant in the light of Canada's known reserve potential. While the long-term market possibilities appear bright, both industry and Government are primarily concerned with problems of the present and early 1970's. Principal contributory elements include a softening in demand due to construction delays; changes in design and rising costs of nuclear powerplants; Canadian Government stockpile purchases destined to end on June 30, 1970; "White Paper" tax proposals which, if adopted, will impose drastic limitations on foreign investment in Canada's uranium industry and a closed-door policy to the United States market under a temporary restriction imposed by the Atomic Energy Commission (USAEC), which prohibits enrichment in the United States of foreign uranium oxide for domestic use. In oversea markets, Canadian producers have met with increasing competition, partly because of Canada's stand on guarantees of uranium for "peaceful use."

Looking to the future, uranium exploration by both Canadian and foreign interests has continued at a high level throughout 1969. Centers of activity were the Elliot and Agnew Lake areas of Ontario, Lac Forestier-Ste-Anne du Lac and Temiskaming areas in Quebec, and Wollaston Lake and Beaverlodge in Saskatchewan.

The three Ontario producers—Denison Mines Ltd., Rio Algom Mines Ltd., and Stanrock Uranium Mines Ltd.—accounted for over 75 percent of the national total in 1969. The balance was from the Eldorado Nuclear Ltd. operation at Uranium City, Saskatchewan. Existing sales contracts of these four companies call for deliveries totaling about 39,000 tons U_3O_8 during the 1968–83 period. Principal deals include 16,300 tons to be supplied to Japanese utilities by the Denison, Rio Algom, and Eldorado companies. Rio Algom has contracted for 13,600 tons to the United Kingdom Atomic Energy Authority and 6,300 tons to the Hydro-Electric Power Commission of Ontario. The Stanrock output, amounting to about two tons of U_3O_8 per month, leached from mine waters was sold to a reactor manufacturer in the United States. According to U.S. Department of Commerce data, U.S. imports from Canada during 1969 contained 150 tons of uranium oxide.

NONMETALS

Asbestos.—Responding to a relatively firm demand, Canadian asbestos producers operated at close to capacity during 1969 and reported output approximately the same as in 1968. About 85 percent of the total was produced by the eight companies (one of which operates three mines) located in southeastern Quebec. The Advocate Mines Ltd. operation at Baie Verte, Newfoundland, accounted for the 3.4 percent credited to that Province, and the two Cassiar Asbestos Corp. Ltd. mines in northern British Columbia and Yukon Territory accounted for 10.6 percent. Ontario's one percent of the national total was from the Reeves Mine (Johns-Manville Mining and Trading Ltd.) near Timmins and the new Hedman Mines Ltd. operation at Matheson.

At Asbestos, Quebec, Canadian Johns-Manville Co. Ltd. continued mill and mine expansion programs aimed at raising fiber output by 90,000 tons annually by 1970. Cassiar Asbestos Corp. also recently announced expansion at Cassiar, British Columbia, that will increase its output 32,000 tons annually by the end of 1970. In March 1969, General Dynamics Corporation of New York, acquired a 54 percent interest in Asbestos Corporation Ltd. and the three mines worked by that company at Black Lake and Thetford Mines, Quebec.

Of the several widely scattered asbestos prospects, two in Quebec attracted considerable attention in 1969. Abitibi Asbestos Mining Co. Ltd. has indicated 93 million tons of fiber-bearing rock and is considering a plant to produce 68,000 tons of fiber annually, near Amos. And in the vicinity of Chibougamau, McAdam Mining Corp. Ltd. is conducting production feasibility

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studies based on a deposit containing reserves estimated at 80 million tons grading 3.87 percent asbestos.

According to official trade statistics, over 99 percent of Canada's production of milled asbestos fiber was exported in 1969. Seventy-five countries participated in this trade. Principal destinations were United States, 583,000 tons; Japan, 142,000 tons; West Germany, 100,000 tons; and United Kingdom, 92,000 tons.

Potash.—Despite the drop in price from Can$0.375 per unit (20 pounds) K_2O equivalent in 1965 to Can$0.213 in 1969, Canadian production of potash in 1969 was 8 percent greater than the previous record set in 1968. Including the two that started during the year, nine mines, all in southern Saskatchewan, contributed to the 1969 production. Nevertheless, technical problems at a few of the mines, voluntary curtailment to meet marketing conditions at others, and provincial production control regulations, resulted in output at less than half the industry's rated 6.3 million tons per year capacity.

Following an antidumping investigation launched in 1967, the U.S. Tariff Commission announced in November 1969 its findings of injury to the U.S. potash industry and applied special dumping duties on potash imports from Canada, France, and West Germany. Since 1967 several Congressional Bills calling for quota limitations have been proposed. Confronted with these developments, the Province of Saskatchewan promulgated The Potash Conservation Regulations, 1969, which became effective January 1, 1970. Under this legislation, potash producers are required to obtain production and disposal licenses, and productive capacities, rates of production, and prices are administered by the Minister of Mineral Resources upon advice of the three-member Potash Conservation Board.

In January, Cominco Ltd. started its new mine and plant, designed for 1.1 million tons of potassium chloride per year, at Vanscoy, 20 miles southwest of Saskatoon. And in July, Noranda Mines Ltd. began production at the Central Canada Potash property at Viscount. When complete, in 1971, this venture is expected to produce 1.4 million tons of potassium chloride annually, for contract sale to a United States fertilizer manufacturer.

Sylvite of Canada Ltd. (subsidiary of Hudson Bay Mining and Smelting Co. Ltd.) is developing a mine 25 miles southeast of Esterhazy and expects to commence production at about 1 million tons per year early in 1971. Looking to a long-range improvement in markets, several other companies are proceeding with development plans in other Saskatchewan areas.

Domestic fertilizer manufacturers consume approximately 8 percent of Canada's potash output. The great bulk of production is exported, with the United States the predominant market. In 1969 total exports of potassium chloride were valued at $83.8 million. According to Dominion Bureau of Statistics, value of shipments to United States totaled $55.4 million; to Japan, $11.6 million; to the Netherlands, $8.4 million; and the remainder to a dozen other countries.

Strontium.—Another element, strontium, will be added to Canada's long list of mineral products in 1970. Kaiser Aluminum & Chemical Corporation (United States) acquired the celestite deposit at Enon Lake, Cape Breton Island, Nova Scotia, in 1969 and plans to market strontium carbonate and nitrate. The deposit was discovered in 1963 and subsequent drilling has indicated about 900,000 tons of celestite containing 75 percent strontium sulfate. Two subsidiaries, Kaiser Celestite Mining Ltd. and Kaiser Strontium Products Ltd., the latter at Point Edwards, near Sydney, Nova Scotia, expect to begin commercial production by mid-1970.

Sulfur.—According to Dominion Bureau of Statistics preliminary estimates, Canadian production of all forms of sulfur in 1969 was at a record level, 11 percent higher than the preceding year. However, owing to the drastic price drop, total value of the year's production was $16.5 million less than in 1968. Elemental sulfur from sour natural gas, which in 1969 accounted for about 80 percent of the national total, was produced by 32 recovery plants in Alberta and one plant each in Saskatchewan and British Columbia. Combined annual capacity of these plants, including the five that first came on stream and the six that expanded during the year, amounted to 5.36 million tons. Actual recovery of gas-derived sulfur in 1969 approximated 3 million tons. Shipments of pyrite and pyrrhotite concentrates, virtually all from mines in Quebec, contained about 162,000 tons recoverable sulfur. In addition sulfuric acid made during the year by Canada's

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base metal smelters contained 560,000 tons.

With production far in excess of domestic requirements, Canada's recent rise to the rank of the largest exporter has in part contributed to a current worldwide oversupply and depressed market situation. Alberta producers receipts, f.o.b. the plants, fell from about $31 per long ton in January 1969 to less than $17 at the close of the year.

As a result of the unfavorable near-term market outlook, interest in exploration for new sour gas sources has been minimal. Nevertheless the increasing demands, both domestic and in western United States, for natural gas persist. To meet anticipated requirements, 11 companies are continuing expansion projects and providing new plants that will add 2 million tons annually to Canada's sour gas sulfur capacity by the end of 1971. Alberta sulfur producers see little hope of improvement in marketing conditions and price before the mid-1970's.

Domestic consumption of sulfur in 1968 was estimated at 1.5 million tons distributed, according to the pattern of earlier years; 51 percent to manufacture of pulp and paper; about 22 percent each to chemicals and fertilizers; and 5 percent to manufacture of rubber and numerous other products. Exports of crude and refined sulfur to 18 countries in 1969 totaled 2,054,122 tons, valued at $58 million. Major destinations were United States, 938,000 tons; Australia, 233,000 tons; and India, 219,000 tons.

MINERAL FUELS

Coal.—Continuing the trend that started in 1966, Canada's total (bituminous, subbituminous, and lignite) coal production fell to a new low in 1969. Although mines in British Columbia and Alberta recorded an increase of 454,000 tons during the year, output of bituminous coal from Nova Scotia and New Brunswick was down 550,000 tons and lignite production from Saskatchewan was 208,000 less than in 1968.

The reduced production from Nova Scotia reflects the first full year of operation and programed streamlining of the coal mining industry by the Government administered Cape Breton Development Corporation. By phasing out unprofitable mines, relocating some workers in new industries, and modernizing mine methods, the Corporation aims at a self-supporting coal mining industry of about 2 million tons annual capacity. A similar form of assistance provided by the New Brunswick Government, backed by a Federal loan, has also been applied to coal mines in the Minto area.

In western Canada, new mine developments continued at a dynamic pace based on contracts calling for delivery of over 180 million tons of coal to Japanese consumers over a 15-year period beginning in 1970. Canadian participants and summary features of contracts in effect in December 1969 are given in the following tabulation:

Company	Location	Contract		
		Period (years)	Quantity (million tons)	Value (millions)
Alberta:				
Coleman Collieries Ltd.	Coleman	15	13.5	$148
Canmore Mines Ltd.	Canmore	10	3.9	46
Cardinal River Coals Ltd.	Luscar	15	15.2	185
McIntyre Mines Ltd.	Grande Cache	15	30.5	416
British Columbia:				
Fording Coal Ltd.	Elk River	15	45.7	601
Kaiser Resources Ltd.	Natal-Fernie	15	76.2	925
Total			185.0	2,321

Kaiser Resources Ltd. operations accounted for less than 1 million tons in 1969, but with completion of preparations, which have included new mining, beneficiation, and transportation facilities that have cost about $100 million, full-scale operations are expected to start in 1970. The bulk of production, initially will be strip-mined from the 50-foot-thick Balmer Seam. The preparation plant is designed to handle 1,270 tons of raw coal per hour.

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Coal shipments from the McIntyre Mines Ltd. Smoky River mines near the new company town of Grande Cache, Alberta, are scheduled to start in April 1970. Highly mechanized underground mining facilities are being provided. The washing plant is designed for 3 million tons per year, and transportation to the port at Vancouver will be in unit trains of 10,000-ton capacity.

The Fording Coal Ltd. deal was signed in 1969. At yearend construction of the 35-mile rail spur from Canadian Pacific Railroad, near Fernie, British Columbia, and preparation of the open pit mine for shipments to begin in 1972 were planned. Fording Coal is owned 60 percent by C. P. Investments Ltd. and 40 percent by Cominco Ltd. Cominco will develop and manage the operation.

Canada's national coal balance for recent years is summarized as follows:

	Million metric tons		
	1966	1967	1968
Production	10.8	10.8	10.0
Imports:			
Anthracite	.6	.5	.4
Bituminous	14.2	13.9	15.8
Total available	25.1	24.7	25.7
Consumption	23.6	22.7	24.5
Exports	1.1	1.2	1.3

Source: Dominion Coal Board.

Principal statistics for the Canadian coal mining industry in 1968, as compiled by Dominion Bureau of Statistics[5] (corresponding data for 1967 in parentheses), were as follows: Number of mines 49 (65); average number of employees 7,669 (8,564); average productivity in metric tons per man-day, total 5.57 (5.22); from strip mines 22.60 (21.32); from underground mines 2.78 (2.88).

Subvention payments for the 1968–69 fiscal year, April 1 to March 31 (1967–68 in parentheses) were reported by the Dominion Coal Board[6] as follows: Tonnage to which applied, 1.31 million (4.83 million) metric tons; total cost $3.43 million ($30.8 million); cost per ton $2.39 ($6.38).

The Dominion Bureau of Statistics estimates 24.1 million tons of coal available for domestic consumption in 1969. Approximately 62 percent of this went to power generation and industrial use; 22 percent to manufacture of coke and gas; and 8 percent to household use. Imports, all from United States amounted to 15.7 million tons. Exports totaling 1.2 million tons included over 1.0 million tons from mines in western Canada to Japan.

Petroleum and Natural Gas.—Responding to the growing demand of both Canadian and United States energy markets, Canadian producers again set new records in 1969. Output of crude oil and natural gas liquids averaged 1.32 million barrels per day, a rate nearly 11 percent higher than in 1968. Daily net withdrawals of new natural gas averaged 5.44 billion cubic feet in 1969, compared with 4.64 billion in 1968. Although seven Provinces and the Northwest Territories contribute, about 98 percent of Canada's oil and gas is produced in Alberta and its neighboring Provinces. Alberta accounted for 77 percent of the estimated $1.3 billion value of Canada's crude oil and natural gas in 1969. Saskatchewan and British Columbia added, respectively, 15 and 7 percent.

Total expenditures for oil and gas exploration activities and development drilling during 1969 amounted to $613 million, compared with $573 million in 1968. Most of this activity was concentrated in Alberta and other areas of western Canada but included a growing interest in offshore areas of both coasts, Hudson Bay, and Arctic Islands. Survey crews spent a total of 1,120 crew-months in the field. Drill crews logged a total of 13.8 million feet in 3,389 completed wells during 1969, compared with 13.8 million feet in 3,149 holes in 1968. Although extensions to several established fields were announced, no oil discoveries of major importance were reported during the year.

Spurred by the growing U.S. market demand, exploration activities and drilling for natural gas accelerated during 1969. Most of this activity was in the Alberta foothills where major discoveries were made in 1967 and 1968. By the end of 1969, exploratory drilling extended over a 60-mile front in the Ricinus-Strachan area.

Shell Canada, Ltd., completed a 14-well test-drilling program off the British Columbia coast and started drilling in the Atlantic Ocean off Sable Island, 100 miles from the Nova Scotia mainland. A number

[5] Dominion Bureau of Statistics. The Coal Mining Industry for the Calendar Year 1968. Cat. No. 26–006 (annual), November 1969, pp. 14, 27.
[6] Dominion Coal Board. Annual Report 1968–1969. Ottawa, Canada, 1969, p. 19.

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of wells were drilled unsuccessfully in 1969 in the Arctic region of Mackenzie River Delta, and an exploratory well was drilled 250 miles east of Churchill, in Hudson Bay, by Aquitaine of Canada, Ltd.

The Canadian Department of Transport icebreaker John A. MacDonald escorted and assisted Humble Oil & Refining Co.'s 143,000-ton icebreaking tanker S.S. Manhattan on its historic voyage through the "Northwest Passage" during the summer of 1969. The effort aimed at determining feasibility of that route as a means of transporting oil from Alaska's North Slope to United States east coast ports. Also under consideration is construction of pipelines from Alaska, down the Mackenzie valley to connect with existing continental pipeline systems serving midwest areas.

The Alberta Government late in the year authorized Syncrude Canada, Ltd., to proceed with construction of a $175 million Athabasca tar-sands project near Fort McMurray. The sands will be recovered with scrapers, and the extraction plant plans call for daily production of 50,000 barrels of synthetic crude, 25,000 barrels of specialty oils, and 5,000 barrels of naphtha, beginning in 1976.

The Canadian Petroleum Association (CPA) estimated proved liquid hydrocarbon reserves in Canada as of December 31, 1969, at 10,516 million barrels. This represented an increase of 498 million barrels during the past year, of which 93 million barrels were attributed to new discoveries; 757 million barrels to revisions; and 108 million barrels to field extensions. Proved reserves of marketable natural gas rose 4,284 billion cubic feet in 1969 to 51,950 billion cubic feet. This represents one of the largest annual increases on record. The year's new discoveries added 1,104 billion cubic feet; revisions and field extensions amounted to, respectively, 2044 and 2,691 billion cubic feet.

Proved reserves of nonconventional crude oil, as of December 31, 1969, were estimated by CPA at 6,334 million barrels. These include only synthetic crude oil recoverable, within an economic mining area, by the Great Canadian Oil Sands plant at Fort McMurray. This estimate in no way detracts from the ultimate potential of 445 billion barrels assigned to Canada's tar and oil sands resource.

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The Mineral Industry of Chile

By Garn A. Rynearson [1]

Political issues played a major role in shaping Chilean mineral policies during 1969 and strongly influenced the Government's decision to take actions that resulted in early Chileanization and provided for eventual nationalization of two of the country's largest copper companies. These actions, together with announcements of numerous new joint ventures in mining activities, were indicative of an acceleration in the trend toward greater State participation in the ownership and management aspects of the mineral industry. Although this trend was of considerable concern to private elements in the industry, it apparently had little impact on the overall productivity and growth of the industry during the year. Operating conditions were nearly normal in most sectors as the problems caused by the severe drought of 1968 and early 1969 were overcome. Furthermore, labor unrest subsided and most of the issues that arose were resolved without serious work stoppages.

The iron and steel and cement industries benefited from the relatively high demand created for their products by the large investment projects underway in the copper, petrochemical, electric power, and sugar refining industries and by increased activity in general construction. In addition, the cement industry was able to utilize some of its excess capacity in the production of substantial quantities of cement for export to Brazil and Argentina. Chile continued to export the bulk of its output of copper, molybdenum, iron ore, and iodine, as well as a large part of the nitrates and rock salt produced.

Continuation of high price levels for copper in the world market helped to generate strong politico-economic pressures on the Government to take measures that would secure for the State a substantial share of the windfall profits being reaped by private copper producers. As a result, the President announced in May the Government's intention to participate in the ownership of those major copper enterprises that had not been included in the Chileanization program begun in 1965. He referred to two wholly owned subsidiaries of The Anaconda Company, Chile Exploration Co. (Chilex), which operated Chile's largest copper mining and processing complex at Chuquicamata, and Andes Mining Co., which operated the El Salvador mine and concentrating plant and the associated Potrerillos smelter and refining. In the bargaining that followed this declaration, The Anaconda Company and the Government of Chile agreed to a negotiated nationalization of the two subsidiaries, and the legal decrees authorizing the State-owned Corporación del Cobre (CODELCO) to purchase shares of new mixed corporations to replace Chilex and Andes were published in the Diario Oficial on November 22, 1969.

The agreement provided for Government acquisition on January 1, 1970, of 51 percent of Anaconda's interest in each of its subsidiaries in exchange for dollar-repayable bonds representing a corresponding percentage of the book value of the companies. The bonds bear 6-percent nontaxable interest and are repayable in semiannual installments over a maximum period of 12 years commencing June 30, 1970. Two new Chilean corporations, Cía. de Cobre Chuquicamata, S.A., and Cía. de Cobre Salvador, S.A., were constituted on December 27 to take over the management of the Chilex and Andes operations. Initial capitalization of the corporations was established at $275,480,000 and $66,637,000, respectively. The agreed value of the net assets transferred by the old companies at yearend was approximately equal to the amounts capitalized.

[1] Physical scientist. Bureau of Mines, Washington, D.C. (deceased).

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The Government will acquire the remaining 49 percent of Anaconda's interest after a minimum of 3 years and when 60 percent of the unpaid balance against the original 51 percent acquisition has been paid, with the provision that the 49-percent acquisition be effected by December 31, 1981. The purchase price is to be determined by multiplying the average annual net earnings to the date of purchase by a factor of 8 if the date occurs in 1973; of 7.5, 7, or 6.5 if the date occurs in 1974, 1975, or 1976, respectively; or of 6 if the date occurs after 1976.

According to the terms of the agreement, CODELCO was to receive preferential dividends equivalent to 51 percent of the after-tax profits derived from the Chilex and Andes operations from September 1, 1969, to the end of the year. In addition, CODELCO was to receive, as a preferential dividend, a portion of aftertax earnings based on the amount by which actual proceeds of copper sold exceed those from sales at a base price of 40 cents per pound, adjusted to increases or decreases in the average-per-pound cost of production. The "over-price" tax rate is 54 percent when copper is sold at 40 to 41 cents per pound and increases for each additional 1 cent in price to a maximum of 70 percent applicable to prices over 50 cents a pound. This over-price tax or dividend was to be applied to copper sales after June 1, 1969. Anaconda agreed to the overprice provisions on the condition these would also be applied to sales by Chile's other large producer, Sociedad Minera El Teniente, S.A., in which CODELCO holds a 51-percent interest, and Braden Copper Co., a subsidiary of Kennecott Corp., holds the remaining 49 percent. El Teniente and Kennecott acceded to this condition in September.

Basic tax rates that applied to Chilex and Andes were amended. The new rates include a direct tax of 30 percent for Cobre Chuquicamata and 29 percent for Cobre Salvador, plus an additional tax of 32 percent and 30 percent, respectively, on dividends paid on Anaconda's interests. Anaconda indicated the new overall tax rate would be 52.4 percent on its interest in Cobre Chuquicamata and 50.3 percent on its interest in Cobre Salvador.

Although policy of the new corporations will be determined by new CODELCO-controlled boards of directors, the basic agreement included 3-year contracts under which Anaconda will receive a management fee of 1 percent of gross proceeds from sales of copper, molybdenum, and other byproducts of the mixed companies.

The nationalization agreement between the Government and Anaconda did not alter the existing agreement pertaining to Cía. Minera Exótica, S.A., in which the Government holds a 25-percent interest and Anaconda a 75-percent interest, nor did it involve the much smaller Santiago Mining Co., a wholly owned Anaconda subsidiary.

The State also sought to increase its revenue from the medium and small sectors of the copper industry when the Congress overrode a Presidential veto of certain tax amendments attached to Law No. 17,242, the 1970 wage readjustment law enacted on December 31, 1969. The new revenue-measures applicable to mining increased sharply the cost of mining permits, extended the 2-cent-per-pound tax on unrefined copper exports to the small producers and established an "over-price" tax for medium-sized copper producers. A base price will be determined for each medium-sized producer to encompass his production costs plus 15 cents. The "over-price" tax rate will be 50 percent of the extra revenue received for copper sold at prices exceeding the base price. The 2-cent tax on unrefined copper exports apparently will apply only when domestic smelting and refining facilities are being utilized at less than capacity levels.[2]

[2] The Anaconda Company. 1969 Annual Report. Mar. 23, 1970, 36 pp.
Chilean Development Corp. (New York). Chile, Economic Notes. No. 47, Aug. 7, 1969, p. 6; No. 50, Oct. 16, 1969, p. 1.
U.S. Embassy, Santiago, Chile. State Department airgram A-192, June 18, 1969, 10 pp.; A-409, Dec. 5, 1969, 13 pp.; A-13, Jan. 9, 1970, 7 pp.

PRODUCTION

Record production levels were registered for mine copper and byproduct molybdenum, ingot steel, cement, and rock salt. On the other hand, crude petroleum production decreased 2.5 percent from the record level attained in 1968. Output of iron ore also decreased slightly, but important expansion projects underway and

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planned indicated substantial growth was in store for this sector. Production of nitrates, iodine, and byproduct sulfates increased notably, as operations were relatively unaffected by labor problems during the calendar year. Although coal output increased, the total amount produced exceeded demand, and unsold stocks were at a relatively high level at yearend.

Table 1.—Chile: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969 [p]
METALS			
Copper:			
Mine output, metal content [2]	663,478	666,664	697,869
Metal, copper content:			
Blister [3]	314,297	312,061	297,572
Refined [4]	[r] 316,771	315,391	361,569
Gold, mine output, metal content—troy ounces	58,135	57,743	59,102
Iron and steel:			
Iron ore and concentrate—thousand tons	10,783	11,916	11,637
Pig iron—do	498	447	485
Ferroalloys—do	10	10	NA
Steel ingots—do	631	570	647
Semimanufactures—do	451	432	481
Lead, mine output, metal content	404	990	832
Manganese ore and concentrate	14,846	23,844	23,699
Mercury—76-pound flasks	184	513	286
Molybdenum, mine output, metal content	4,740	3,853	4,842
Silver, mine output, metal content—thousand troy ounces	3,156	3,739	3,133
Zinc, mine output, metal content	1,123	1,255	1,478
NONMETALS			
Barite	4,504	3,677	4,494
Cement, hydraulic—thousand tons	1,235	1,251	1,436
Clays:			
Kaolin	29,424	26,134	41,792
Other	91,685	86,202	74,786
Diatomite	29	-------	-------
Feldspar	871	975	990
Fertilizer materials, crude natural:			
Nitrates:			
Sodium	762,108	622,881	656,939
Potassium enriched	107,142	55,976	124,729
Phosphates, guano	16,307	22,612	17,130
Fluorspar, all grades	455	-------	-------
Gem stones, lapis lazuli—kilograms	-------	8,200	3,151
Gypsum:			
Crude	132,547	103,063	131,787
Calcined	42,448	55,472	52,781
Iodine, elemental	2,216	1,964	2,449
Pigments, natural mineral, iron oxide	19,762	17,761	31,534
Pozzolan	134,177	156,391	175,215
Quartz:			
Common quartz	146,954	121,248	99,141
Glass sand	3,341	33,718	38,350
Salt, all types—thousand tons	418	853	1,330
Stone, not further described:			
Dolomite	233	-------	-------
Marble	982	3,573	1,771
Sulfates, sodium:			
Natural, mined	17,747	19,391	26,897
Anhydrous, coproduct of nitrate industry	NA	NA	51,909
Sulfur:			
Native, other than Frasch:			
Refined, sulfur content	45,710	41,358	46,717
Unrefined, sulfur content	10,259	21,615	51,943
Sulfur content of acid derived from pyrite and industrial gases	12,187	12,122	13,535
Talc	2,881	2,813	809
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous and lignite—thousand tons	1,496	1,611	1,704
Coke:			
Oven—do	287	304	317
Gashouse—do	[e] 73	[e] 57	NA
Gas, natural:			
Gross production [5]—million cubic feet	248,597	246,784	263,790
Sold to consumers [5]—do	318	528	468
Treated in plants [5]—do	158,887	153,597	152,656
Injected [5]—do	188,555	178,470	183,839
Natural gas liquids, gross production: [6]			
Condensate—thousand 42-gallon barrels	1,292	1,216	1,185
Natural gasoline—do	483	499	444
Liquefied petroleum gases [7]—do	1,498	1,468	1,407

See footnotes at end of table.

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Table 1.—Chile: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]		1967	1968	1969 [p]
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum: [6]				
Crude	thousand 42-gallon barrels	12,369	13,695	13,350
Refinery products: [8]				
Gasoline and naphthas:				
Aviation gasoline	do.	283	226	225
Motor gasoline	do.	8,241	8,575	9,728
Naphthas	do.	140	187	194
Kerosine	do.	2,330	2,491	2,759
Distillate fuel oils	do.	4,012	4,736	4,651
Residual fuel oil	do.	7,883	8,538	8,823
Liquefied petroleum gas	do.	1,657	1,697	1,975
Asphalt, refinery	do.	31	41	56
Solvents	do.	130	121	147
Other, n.e.s.	do.	83	116	162

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to commodities listed, Chile also produces unreported amounts of borates, lime, selenium, vanadiferous slag, and manufactured gas.

[2] Figures shown represent the nonduplicative copper content of ores, concentrates, precipitates, metal, or other copper-bearing products, measured at the least stage of processing represented in available statistics.

[3] Data include blister produced for export as well as unspecified quantities produced and retained in Chile for refining at the Las Ventanas electrolytic refinery.

[4] Data exclude electrolytic copper produced at the Las Ventanas refinery in order to avoid double counting of some copper included in data shown for blister. Metal content of electrolytic copper output at Las Ventanas was 67,053 tons in 1967; 80,959 tons in 1968; and 87,074 tons in 1969.

[5] Converted from cubic meters at rate of 1 cubic meter equals 35.3145 cubic feet.

[6] Data converted from cubic meters at rate of 1 cubic meter equals 6.28981 42-gallon barrels.

[7] Data apparently represent net plant output for consumption and are presumed to exclude reinjected quantities as follows, in thousand 42-gallon barrels: 1967—36; 1968—19; 1969—20.

[8] Data represent gross output of finished products, including quantities consumed by Empresa Nacional del Petróleo for refinery fuel and other purposes.

Sources: Servicio de Minas del Estado, Dirección de Estadística y Censos, Instituto Latinoamericano del Fierro y el Acero, and Empresa Nacional del Petróleo.

TRADE

Customs data indicated the value of Chile's trade in mineral commodities during 1968 declined slightly compared with that in 1967, whereas trade in all commodities increased slightly. The net trade balance for mineral commodities remained virtually unchanged, as the relatively small net decreases in dollar values of both exports and imports of such commodities were almost the same. These decreases were primarily due to lesser quantities of steel exported and of crude petroleum imported.

Mineral commodities continued to dominate the country's export trade, accounting for almost 90 percent of the total value. The customs values for all forms of unmanufactured copper and copper-bearing raw materials exported totaled $716.4 million, compared with $718.2 million in 1967, and represented 76 percent of total exports.

A tabulation comparing trade in mineral commodities and total trade follows:

	Value (million dollars)	
	1967	1968
Exports:		
Mineral commodities:		
Metals	830.0	816.1
Nonmetals	25.3	25.0
Mineral fuels	1.0	.9
Total	856.3	842.0
All commodities	913.0	940.8
Imports:		
Mineral commodities:		
Metals	23.5	22.9
Nonmetals	25.2	25.6
Mineral fuels	61.3	47.3
Total	110.0	95.8
All commodities	726.6	742.7
Net trade balance:		
Mineral commodities	+746.3	+746.2
All commodities	+186.4	+198.1

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Table 2.—Chile: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum, metal, including alloys, all forms	2	5	Mainly to West Germany.
Copper:			
Ore and concentrate	17,904	11,251	Japan 5,577; West Germany 3,758.
Slag, ash, and residues	616	854	Mainly to Sweden.
Sulfate	388	518	Mainly to Brazil.
Metal, including alloys:			
Unwrought:			
Unrefined:			
Precipitates, including cement	25,448	21,630	Japan 12,265; Spain 6,627.
Blister	246,984	224,931	United States 133,120; United Kingdom 37,139; Japan 17,465.
Refined	371,506	382,288	United Kingdom 75,313; Netherlands 73,288; Italy 48,074.
Master alloys	2	-------	
Semimanufactures	9,652	10,747	Venezuela 3,582; Peru 1,907; Colombia 1,278.
Gold, ore and concentrate	20,736	29,683	West Germany 16,442; Japan 9,108; Poland 4,000.
Iron and steel:			
Ore and concentrate—thousand tons	9,894	10,497	Japan 8,722; United States 1,388.
Slag	1,869	4,509	All to United States.
Metal:			
Pig iron, cast iron, and similar materials	5,058	-------	
Ferroalloys:			
Ferromanganese	1,458	505	All to United States.
Ferromolybdenum	475	493	West Germany 159; Republic of South Africa 137; Spain 66.
Other	302	484	All to Colombia.
Steel, primary forms	33,114	18,305	Japan 9,688; Panama 5,995; Uruguay 2,622.
Semimanufactures	56,056	13,574	Argentina 8,018; Uruguay 3,413.
Manganese, ore and concentrate	6,397	2,540	All to West Germany.
Mercury—76-pound flasks	-------	44	Mainly to Argentina.
Molybdenum:			
Concentrate	7,316	5,822	West Germany 1,512; Netherlands 1,248; Sweden 1,152.
Oxide, all grades	1,455	1,162	Japan 514; West Germany 317; Austria 159.
Nickel, metal, scrap	31	-------	
Silver:			
Ore and concentrate	33,419	43,666	Mainly to West Germany.
Metal—troy ounces	70,217	-------	
Zinc:			
Ore and concentrate	2,079	-------	
Scrap, ash, residues	249	637	All to Belgium-Luxembourg.
Other, metal-bearing slag, n.e.s	-------	1,883	All to United States.
NONMETALS			
Boron materials, crude natural borates	60	410	All to Uruguay.
Cement	500	5,032	Mainly to Brazil.
Fertilizer materials, crude, natural nitrates:			
Sodium	518,999	458,242	United States 165,664; Netherlands 78,657; Spain 66,495.
Potassium enriched	98,937	58,350	United States 38,700; Brazil 7,761.
Iodine	2,344	2,028	United States 989; Netherlands 652.
Precious and semiprecious stone, lapis lazuli—kilograms	3,681	5,110	West Germany 3,687; Italy 675; United States 405.
Salt	258,895	681,304	Japan 455,134; United States 226,170.
Other nonmetals, n.e.s—value	$1,603	$1,525	Mainly to France.
MINERAL FUELS AND RELATED MATERIALS			
Coal	800	1,111	Mainly to Bolivia.
Natural gas liquids	37,928	28,993	All to Argentina.
Other mineral fuels and related materials, n.e.s—value	$352	$6,312	United Kingdom $4,680; Argentina $1,632.

Source: Camara de Comercio de Santiago de Chile. Comercio Exterior, Chile, 1967 and 1968.

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Table 3.—Chile: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite and concentrate	11	852
Oxide (alumina) and hydroxide	257	111
Metal, including alloys:		
Scrap	36	15
Unwrought	4,074	3,178
Semimanufactures	1,026	1,139
Antimony, metal	28	80
Arsenic:		
Trioxide, pentoxide, and acids	120	46
Metal	5	15
Cadmium, metal	5	3
Chromium:		
Chromite	16	168
Oxides and hydroxides	48	78
Copper:		
Ore and concentrate	55	----------
Metal, including alloys, all forms	117	151
Gold, metal, unworked or partly worked, troy ounces	101	64
Iron and steel:		
Pig iron, including spiegeleisen	895	2,760
Sponge iron, powder, and shot	124	132
Ferroalloys:		
Ferromanganese	1,486	2
Other	335	299
Ingots and other primary forms	203	8
Semimanufactures:		
Bars and rods	2,376	2,674
Angles, shapes, sections	4,209	7,076
Universals, plates, sheets	3,590	4,360
Hoop and strip	509	636
Rails and accessories	8,487	13,889
Wire	778	750
Tubes, pipes, fittings	9,876	9,524
Castings and forgings, rough	1,436	587
Lead:		
Oxides	15	21
Metal, including alloys:		
Scrap	47	47
Unwrought	855	1,941
Semimanufactures	670	1,050
Mercury, 76-pound flasks	5	23
Nickel:		
Matte, speiss, and similar materials	16	5
Metal, including alloys, all forms	93	204
Platinum-group metals, including alloys, all forms, troy ounces	294	----------
Selenium, elemental, kilograms	963	3,375
Tin:		
Oxides	10	4
Metal, including alloys, all forms, long tons	950	689
Titanium:		
Ore and concentrate (rutile)	74	50
Oxides	2,087	2,542
Zinc, metal, including alloys:		
Scrap and blue powder	(1)	39
Unwrought	6,573	2,924
Semimanufactures	70	76
Zirconium, ore and concentrate	234	162
Other:		
Ore and concentrate, n.e.s., value	$68,783	$4,683
Ash and residue containing nonferrous metal, do	$9,236	$3,439
Oxides, hydroxides, and peroxides of metals, n.e.s., do	$63,216	$100,261
Metals, including alloys, all forms, n.e.s., do	$215,039	$45,719
NONMETALS		
Abrasive stone, powder, and grain, n.e.s.	429	441
Asbestos	8,995	8,657
Barite and witherite	1,412	27
Cement	12,775	16,334
Chalk	229	2
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s.:		
Bentonite	3,158	8,943
Fuller's earth	18	105
Kaolin	168	203
Other	363	277
Products:		
Refractory (including nonclay brick and cement)	19,531	10,822
Nonrefractory	224	152
Diamond, industrial, carats	675	30,050
Diatomite and other infusorial earths	258	362
Feldspar	32	12

See footnotes at end of table.

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Table 3.—Chile: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968
NONMETALS—Continued		
Fertilizer materials, crude and manufactured:		
Nitrogenous	15,832	45,506
Phosphatic	170,472	186,877
Potassic	36,440	29,014
Other, including mixed	(1)	2,001
Fluorspar	2,218	495
Graphite, natural	318	68
Magnesite	2,727	6,998
Mica, all forms	24	198
Pigments, mineral, including processed iron oxides	140	123
Pyrite	---	122
Sodium and potassium compounds, n.e.s.:		
Caustic soda	11,896	15,059
Caustic potash, sodic and potassic peroxides	124	126
Stone, sand, and gravel:		
Dimension stone	41	46
Dolomite	85,350	86,629
Other	41	109
Sulfur:		
Elemental, all forms	32,612	38,586
Sulfuric acid	19	18
Talc, steatite, soapstone, pyrophyllite	218	135
Other nonmetals:		
Oxides and hydroxides of magnesium, strontium, and barium	97	104
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s.—value	$17,317	$27,291
Mineral insulating materials, crude or processed—do	$153,930	$38,526
Other, n.e.s.—do	$58,263	$103,044
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	296	201
Carbon black and gas carbon	2,030	3,391
Coal, all grades, including briquets	288,577	208,643
Coke and semicoke	136	---
Hydrogen, helium, and rare gases	60	89
Natural gas liquids	36,075	14,539
Peat, including peat briquets and litter	6	17
Petroleum:		
Crude	2,141,544	1,925,235
Refinery products:		
Gasoline—42-gallon barrels	189,118	82,341
Kerosine and jet fuel—do	418,293	850,064
Distillate fuel oil	124,786	53,707
Residual fuel oil	320,635	1,367,654
Lubricants	39,120	42,420
Mineral jelly and wax	11,802	7,269
Other	2,706	50,134
Mineral tar and crude chemicals from coal, petroleum, and natural gas	182	633

[1] Less than ½ unit.

Source: Camara de Comercio de Santiago de Chile. Comercio Exterior, Chile, 1967 and 1968.

COMMODITY REVIEW

METALS

Copper.—Some copper producers were adversely affected by water and power shortages as the drought extended into the early months of the year, and production losses were incurred by two of the large producers as their operations were temporarily curtailed by technical problems. Despite these difficulties, most producers operated at or slightly above 1967 levels. A major part of the overall increased output registered by the industry for 1968 and 1969, resulted from expansion in the medium and small copper mining and processing operations. Expansion programs were underway in all sectors of the industry, preparations for bringing two major new mines into production were well advanced, and several new mining and processing projects were started. Although a number of projects may require several years to complete, some of the larger expansion and development projects should be completed during the latter part of 1970 and early in 1971, and Chile's copper output can be expected to register a marked increase in 1971.

Although operations at the El Teniente mine of Sociedad Minera El Teniente, S.A., were below normal during the first quarter of 1969 because of continued effects of the drought, productivity during the re-

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mainder of the year was above normal. In 1969 the company mined and milled a record total of 12.4 million metric tons of ore with an average copper content of 1.85 percent. Preliminary official statistics indicate the company produced 117,790 metric tons of copper in blister form as well as 68,427 tons in fire-refined form for a record total output of 186,217 tons, exceeding the previous high total set in 1967 by 4,671 tons.[3] Incomplete data indicated approximately one-third the blister not further refined by the company was electrolytically refined on a toll basis by the Government-owned Las Ventanas refinery.

At yearend the company had spent nearly 80 percent of the $230 million investment authorized for projects to increase annual production capacity by 100,000 tons to 280,000 tons.[4] These projects include improving and expanding the mining and processing facilities, relocation of employees and other residents of the old, high-altitude mine and mill communities of Sewell and Caletones to the more habitable city of Rancagua in the central valley, and replacement of the old access railroad from Rancagua with a modern highway. The highway, part of new housing projects, and several mine and mill projects were completed during the year. Completion of the expanded mine and mill facilities was scheduled for the latter part of 1970.

During 1969, the Government's CODELCO paid Braden Copper Co. $34.1 million which represented the remaining principal amount due on the original $80 million in notes Braden received from the sale of a 51-percent equity interest in the El Teniente complex when it was Chileanized in 1967. As originally stipulated, the $80 million paid by CODELCO has all been lent to the mixed company on 5.75 percent notes, the principal sum of which is to be paid to Braden in 30 semi-annual installments starting December 31, 1971.

Chilex increased copper production slightly at Chuquicamata to 280,912 metric tons. Of the total amount, 207,200 tons was in electrolytic form and 73,712 tons was in blister form and not further processed. A huge landslide on the west wall of the open pit in February disrupted the rail haulage system and caused an estimated production loss of 14,000 tons of copper before the transport system could be modified to provide an adequate supply of ore to the mills. On the other hand, the company set a monthly output record of 30,815 metric tons of copper in August, compared with a nearly average output of 23,690 tons in July.

The $114 million investment program to expand mine, mill, smelter, and refining facilities and to increase water and power supplies was well advanced, with $105.7 million having been expended at yearend. An additional $7 million investment for the purchase of equipment was authorized during the year. Among the projects completed in 1969 was the installation of a 70-ton-per-hour shaft furnace to augment the capacity of the casting plant. Installation of a Doré furnace was planned to permit on-site recovery of precious metal values from anode slimes, which are reported to contain selenium and tellurium also. A major project underway was construction of a 4,940-foot conveyor belt system which will transport ore from a primary crusher located on the pit floor through a 3,300-foot inclined tunnel to a large storage bin near the mill. This system will replace all railway and most of the truck haulage of ore from mine to mill and will deliver approximately 26 million tons of ore annually to the sulfide ore concentrator.

Expansion of the Chuquicamata processing facilities was scaled to accommodate the toll-treatment of oxide ore from the nearby Exótica deposit, which Cía. Minera Exótica, S.A., expected to be in production by mid-1970. By yearend, stripping of overburden from this deposit was virtually completed, and more than 1 million tons of ore had been stockpiled. Upon completion of the crushing and blending plant and the conveyor belt transport system, the Exótica ore will be sent to the Chuquicamata oxide ore plant for leaching and the eventual recovery of electrolytic copper at an expected rate of about 112,500 tons per year. The Exótica deposit is estimated to contain 153 million tons of ore containing 1.35 percent recoverable copper, assuming 80 percent of the total copper can be recovered.

Andes Copper Mining Co. was forced to shutdown much of its mine and mill operations for 3 weeks to repair accidental

[3] Quantities of copper given here and elsewhere in this review represent fine copper content of the product indicated.

[4] In this review, data representing production capacities or estimated future production are given as reported and usually represent short tons rather than metric tons.

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damage to the conveyor belt system between the primary crusher and coarse ore bins at El Salvador. During the shutdown, the furnaces of the smelter at Potrerillos, which normally smelt El Salvador concentrate, were kept hot by smelting 4,000 tons of concentrate shipped from Chuquicamata. This accident was largely responsible for a decrease of about 9,100 tons in copper output compared with 1968 production. In 1969, Andes produced 58,741 metric tons of copper in electrolytic form as well as 18,392 tons in unrefined blister form.

Most of the small and medium copper mining and processing ventures managed only slight to modest increases in output during 1969, being limited mainly by installed plant capacity. However, their aggregate output of copper in all forms increased to 153,107 metric tons compared with 146,815 tons in 1968 and 126,548 tons in 1967. Empresa Nacional de Mineria (ENAMI), which processes a large part of the mine, mill, and smelter products of the small and medium mines, increased production of copper in blister form at its Paipote smelter to 24,687 metric tons and at its Las Ventanas smelter to 42,149 tons, compared with outputs of 22,171 tons and 38,219 tons, respectively, in 1968. The refinery unit at Las Ventanas produced 87,074 metric tons of copper in electrolytic form compared with 80,959 tons in 1968. Production at all three of these plants was in excess of their nominal capacities of 20,000 tons of blister at Paipote and 40,000 tons of blister and 84,000 tons of electrolytic copper at Las Ventanas. Therefore, ENAMI began to implement plans for expansion of its total smelting capacity to 100,000 tons of blister copper and its refining capacity to 112,000 tons of electrolytic copper per year.

Numerous new medium- and small-scale projects were in various stages of implementation or planning during the year. These included some all-private ventures, but most involved a measure of Government participation with private Chilean and foreign interests and several foreign government agencies. The largest and most advanced was the Río Blanco project of Cía. Minera Andina, S.A., in which Cerro Corp. holds a 70-percent equity interest and CODELCO holds the remaining 30 percent. At yearend the work was estimated to be 75 percent completed, and nearly $100 million of the authorized investment of $157 million had been expended. The mine, mill, and concentrating facilities were scheduled to begin operating early in 1971. The Río Blanco deposit, which has been only partly delimited, is estimated to contain at least 120 million tons of ore averaging 1.58 percent copper. Initial annual production will be at a rate of 67,500 short tons of copper contained in concentrates, part of which will be smelted at Las Ventanas and the remainder exported to Japan.

After several years of negotiation and exploration, the way was cleared for Cía. Anónima Cuprífera de Sagasca to begin a $32.5 million project to exploit the Sagasca deposit east of Iquique. Equity in this mixed company is divided as follows: Continental Copper and Steel Industries, Inc., holds 59 percent; CODELCO 25 percent; International Finance Corp. 15 percent; and 1 percent is split among numerous Chilean investors. The company hopes to be producing cement copper at an annual rate of about 24,000 metric tons by the latter part of 1970 or early in 1971.

The mining properties of Santiago Mining Co., a wholly owned subsidiary of The Anaconda Company, were sold to a group of private Chilean investors; however, Anaconda retained a 50-percent interest in the subsidiary's real estate holdings near Santiago. Santiago Mining Co. had been producing roughly 5,000 tons of copper in concentrates annually from the La Africana mine. Since the reserve of ore at La Africana has been nearly depleted, the nearby Lo Aguirre property will be developed and put into production by the new owners.[5]

[5] The Anaconda Company. Preliminary Income Statement, 1969. Feb. 9, 1970, 2 pp.
Canadian Mining Journal. The Giant Operations of Chuquicamata. V. 91, No. 7, July 1970, pp. 60–63.
Cerro Corp. 1969 Annual Report. Feb. 27, 1970, pp. 11–12.
Chilean Development Corp. (New York). Chile, Economic Notes. No. 51, Nov. 10, 1969, p. 1; No. 59, May 8, 1970, p. 3.
Kennecott Copper Corp. Quarterly Report, Third Quarter and First Nine Months, 1969. Oct. 20, 1969, 2 pp.
———. Annual Report, 1969. Feb. 20, 1970, pp. 11, 15, and 31.
Mining Engineering. Copper in the Andes. V. 21, No. 11, Nov. 1969, pp. 59–90.
———. Sagasca Mine Given Go Ahead. V. 22, No. 5, May 1970, pp. 27–28.
Skillings' Mining Review. Anaconda Resumes Operation of El Salvador Copper Mine. V. 59, No. 42, Oct. 18, 1969, p. 26.
World Mining. V. 5, No. 12, November 1969, p. 52.

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Iron Ore.—Japan's six largest integrated steel companies jointly entered into an agreement with Canadian Foreign Ore Development Corp. to purchase 3 million tons of Chilean iron ore pellets and 1 million tons of sinter fines annually during the period 1973–93, with the option to buy an additional 1.5 million tons of either pellets or fines per year. The agreement specified a minimum iron content of 64 percent for pellets and 59 percent for sinter fines. The ore is to be supplied by the Cía. Minera Santa Bárbara-Cía. Minera Santa Fe combine, which will mine and beneficiate the low-grade (38 to 45 percent iron) ore from the large Cerro Negro Norte deposit west of Caldera. Selection of locations for the beneficiation and pelletizing facilities awaited further studies; however, the ore will be shipped from Caldera where port facilities will be improved to accommodate 160,000-ton to 250,000-ton ore carriers that will be specially built to service this new operation. When implemented, this project probably will become the largest iron ore operation in Chile. Previously, Santa Bárbara and Santa Fe mined ore from various scattered deposits and also purchased ore from small producers to supplement their export shipments, which averaged approximately 5 million tons per year during 1967–69. It was not indicated whether the Santa Bárbara-Santa Fe interests will concentrate their efforts on the Cerro Negro Norte project in the future or if they plan to continue working other deposits as well.[6]

Two Japanese firms, Mitsubishi Mining Co., Ltd., and Ataka & Co., Ltd., conducted preliminary studies on the feasibility of large-scale exploitation of the Santa Clara deposit east southeast of Chañaral. The deposit was estimated to have reserves of about 50 million tons of iron ore. Subject to Government approval of the project, the two firms proposed production of approximately 2.4 million tons of sinter fines annually for export to Japan. The Yawata and Fuji steel companies reportedly have agreed to buy the ore on a 10-year contract basis. In addition to mine development, the firms envisage the construction of a port at Flamenco Bay to accommodate 150,000-ton ore carriers, a concentrating plant at the port to process the ore for export, and a 25-mile conveyor belt to link the mine and concentrator. It was estimated the venture would require an investment of $40 million and that the first export shipments could be made in 1972.[7]

Bethlehem-Chile Iron Mines Co. was engaged in expanding mine, concentrator, and rail transport facilities at its El Romeral mine to raise annual production capacity of marketable ore from 3 million to 4.5 million tons. Work also was underway to deepen the port of Guayacán so that 80,000-ton ore carriers can be accommodated. The company was authorized to increase its capital investment in this expansion program from $20 million to $25 million, and completion was rescheduled for 1972 instead of 1971.[8]

Iron ore shipments during 1969 by Bethlehem-Chile Iron Mines Co. through the ports of Guayacán (El Romeral ore) and Cruz Grande (El Tofo ore) were reported as follows in metric tons:

Romeral Division:	
Furnace ore to United States	532,227
Furnace ore to Japan	1,249,322
Furnace ore to CAP steel mill	947,266
Total	2,728,815
Tofo Division:	
Furnace ore to United States	204,987
Fines to United States	89,768
Local sales of fines	361
Total	295,116

Source: Skillings' Mining Review. V. 59, No. 11, Mar. 14, 1970, p. 12. (Original data in short tons converted at rate of 1 short ton equals 0.907185 metric tons.)

During 1969, Cía. de Acero del Pacífica, S. A. (CAP), produced 3,225,944 metric tons of ore at the Algarrobo mine compared with 2,605,057 tons in 1968. Of the 1969 total, 2,867,775 tons was blast furnace ore and 358,169 tons was sinter fines. The company shipped 2,497,570 metric tons of blast furnace ore and 462,672 tons of fines from its port at Guacolda. Over 91 percent of the blast furnace ore and part of the fines exported were shipped to Japanese customers, with the remainder sold to firms in the United States and Canada.

A new ore beneficiation plant was under construction at the Algarrobo mine and was scheduled to begin operating about

[6] American Metal Market. V. 76, No. 224, Nov. 26, 1969, p. 5.
The Japan Times. $1.2 Billion Chile Pellet Deal Closed. Nov. 26, 1969, p. 10.
[7] Bank of London & South America Review. V. 3, No. 36, December 1969, p. 776.
Metal Bulletin (London). No. 5447, Nov. 7, 1969, p. 37.
[8] U.S. Embassy, Santiago, Chile. State Department airgram A-310, Sept. 22, 1969, 21 pp.

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mid-1970. This plant is expected to recover approximately 700,000 tons of sinter fines annually from rejects of the crusher plant and similar rejects from the large stockpile that has accumulated since mining operations began. Expansion of port facilities at Guacolda to permit servicing vessels with capacities up to 80,000 tons was completed in June. CAP plans to deepen the port in the future to allow loading of carriers that can hold 150,000 tons or more.

CAP continued exploration of the Alcaparra and Añañuca deposits near the Algarrobo mine. The company also continued to study the feasibility of future exploitation of low-grade iron ore deposits in the Cordillera de Nahuelbuta in Arauco Province. CAP tentatively agreed to undertake the development and eventual exploitation of the Boquerón Chañar deposits located about 60 kilometers north of Vallenar, where preliminary exploration sponsored by the Corporación de Fomento de la Producción (CORFO) has indicated large reserves of ore ranging in grade from 35 to 60 percent iron.[9]

Iron and Steel.—Shortage of electric power continued to hamper operations of the Huachipato steel mill of CAP, during the early part of 1969. The shortage became especially acute after the seasonal surplus of power generated for the sugar industry became unavailable, but by mid-April, the problem was solved by the installation of auxilliary diesel electric equipment imported from the United States. Despite restricted power, and in response to increased domestic demand for steel products, the mill established new records for output of ingot steel and finished rolled products.

Preliminary data reported by the Banco Central de Chile indicated CAP produced 483,715 metric tons of pig iron in 1969 compared with 425,050 tons in 1968 and 497,677 tons in 1967. The bank also reported ingot steel output by CAP was 601,700 tons in 1969 compared with 525,600 tons in 1968 and 596,200 tons in 1967. Shipments of finished products to domestic and export markets for 1967–69 were as follows, in thousand metric tons:

	1967	1968	1969
Domestic	368.9	384.2	482.0
Export	68.0	21.1	4.9
Total	436.9	405.3	486.9

Implementation of plans to expand the mill's steelmaking capacity to 1 million tons per year was slowed by delays in completing the necessary financing arrangements. However, orders were placed for (1) U.S. equipment to increase the rolling capacity of the mill and (2) for European equipment for a new steel shop with two 100-ton oxygen converters, for a 290-ton-per-day oxygen plant, and for a lime plant. The company completed installation and began operating its new $9.5 million electrolytic tinning line. Capacity of this facility is 65,000 tons per year, which is considered adequate to supply the domestic demand for tinplate in the immediate future.[10]

Cía. de Productos de Acero "COMPAC", S.A., inaugurated a new $5 million plant near Concepción which will utilize CAP steel to make pipe and tubes ranging in diameter from ⅛ to 4 inches. The output of this plant and that of the company's smaller plant at Maipú should satisfy most of the domestic market for pipe and tubes of these sizes. Expansion projects also were in progress or planned at other small steel companies. Establecimientos Metalúrgicos Indac, S.A., Industrias de Acero, expected to begin construction in 1970 of a new plant at Rengo to produce 33,000 tons of high carbon and alloy steels and 23,000 tons of rolled products per year. Industrias Metalúrgicas AZA, S.A., which has a rolling mill capacity of 18,000 tons per year, plans to expand its capacity to produce carbon and special steels to 20,000 tons annually.[11]

Vanadium.—CAP exported trial amounts of vanadiferous open-hearth slag to the United States during 1968, and in February 1969 began making commercial shipments to its customer at the rate of about 30,000 tons per year. The slag contains 5 to 6 percent V_2O_5, representing the residual concentration of about 0.4 percent vanadium contained in the iron ore the CAP steel mill receives from the El Romeral mine of Bethlehem-Chile Iron Mines Co.

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[9] Cía. de Acero del Pacífico, S.A. Annual Report, July 1, 1968, to June 30, 1969, 39 pp. Skillings' Mining Review. V. 59, No. 14, Apr. 4, 1970, p. 6.

[10] First work cited in footnote 9.

[11] Revista Latinoamericana de Siderurgia. No. 112, August 1969, p. 19; No. 115, November 1969, p. 36.

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NONMETALS

Nitrates.—CORFO contracted the services of a U.S. firm to conduct an independent three-part feasibility study on potential ways of diversifying or otherwise improving the efficiency of the operations of Sociedad Química y Minera de Chile, S.A. (SOQUIMICH), the mixed company that was formed to consolidate the management of Chile's ailing nitrate and by-product iodine industry. This study represented yet another of a series of continuing efforts to insure the survival of a traditional Chilean industry that provides the livelihood for more than 9,000 workers and their families.

Although the major portion of Chilean natural nitrate output is exported, substantial quantities are marketed in the country for agricultural, industrial, and other uses. One nonagricultural use of sodium nitrate in the country is its utilization in slurry-type nitrate/fuel oil explosives. During 1969, SOQUIMICH became directly involved in this relatively small but growing market when it agreed to participate with Ireco Chemicals of Salt Lake City in a new venture to produce explosives and related chemicals at Antofagasta and Calama. Ireco was authorized to invest $350,000 in the project, and SOQUIMICH was committed to contribute the equivalent of $125,000 for its share in the partnership.[12]

Salt.—Cía. Minera Santa Adriana, S.A. (COMISA), which operates a multiple-bench, open-pit rock salt mine about 40 kilometers south of Iquique, reported production of 1,036,491 metric tons of marketable grades of salt during 1969. In addition, the company stockpiled 103,566 tons of minus 12-mesh fines that accumulated at the crushing and screening plant at Patillos Bay. COMISA reported salt shipments during 1969 totaled 946,344 metric tons, an increase of 27 percent above the 1968 level. The company exported 513,990 tons to the United States and 364,241 tons to Japan and marketed the remaining 68,113 tons in Chile. Increased output was attributed partly to acquisition of additional trucks during the year as well as to improvements made to mine facilities and crushing plant installations.

In December, Diamond Crystal Salt Co. acquired a 42.5-percent equity interest in COMISA. Marcona Corp., which previously held a 73.5-percent interest, retained a 42.5-percent share in the company, with the remaining 15 percent being owned by a group of Chilean stockholders. It was indicated that COMISA plans to increase its output to 2 million tons annually as soon as possible and may eventually expand its capacity to 4 million tons per year.[13]

MINERAL FUELS

Coal.—During the latter part of 1968, the Government was deeply concerned about coal supply shortages in 1969 if the drought should continue. It urged coal producers to step up their production and also decided to permit a substantial increase in the coal import quota to help cover anticipated shortages during the early months of the year. The domestic coal industry responded by increasing gross output 5.8 percent over that of 1968 and slightly exceeded its production goal of 1.7 million tons. However, when drought conditions eased in many parts of the country early in the year, the extraordinary demand for coal by thermal powerplants dropped markedly as hydroelectric plants were able to resume more normal operations. As a result of decreased demand in an important sector of the market, the major coal producer accumulated a stockpile of more than 300,000 tons by the third quarter of the year as compared with stocks of about 90,000 tons at yearend 1968. The producer's plight was further aggravated by delay in the completion of the new 125,000-kilowatt Bocamina thermal-electric plant located at Coronel, which had been scheduled to be operative in the latter part of 1969. This plant is expected to consume about 300,000 tons of coal annually from nearby mines and should provide a welcome boost to the coal industry upon completion in 1970.

Chile normally restricts the bulk of its coal imports, which are mainly of U.S. origin, to the quantities required for blending with domestic coal for the manufacture of metallurgical coke at the CAP steel

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[12] Banco Central de Chile. Boletin Mensual, No. 499, September 1969, p. 1083.
Bank of London & South America Review. V. 3, No. 35, November 1969, p. 704.
Chilean Development Corp. (New York). Chile, Economic Notes. No. 54, Jan. 5, 1970, p. 4.

[13] Diamond Crystal Salt Co. 1970 Annual Report, fiscal year ending Mar. 31, 1970, p. 2.
Industrial Minerals (London). No. 29, February 1970, p. 43.
Skillings' Mining Review. V. 59, No. 9, Feb. 28, 1970, p. 4.

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mill. The emergency quota increase authorized late in 1968 permitted the United States to export 471,286 metric tons of coal to Chile in 1969 compared with 278,369 tons in 1968. Most of the additional quantity of high-quality U.S. coal imported apparently was consumed for coking purposes also. For the period January through September 1969, CAP reportedly received approximately 276,000 tons of U.S. coal and only 96,000 tons of domestic coal. This proportion of roughly 74 percent imported and 26 percent domestic coal is in sharp contrast to the normal blend of 60 percent domestic and 40 percent imported coal used by CAP.[14]

Petroleum and Natural Gas.—Chile's entire crude petroleum output has been from onshore fields in Magallanes Province. Annual output from these fields apparently has attained a near maximum level, with variations on a yearly basis of only about 5 percent or less from the average daily production of approximately 35,750 barrels during the period 1963–69. Exploration in other parts of the country have thus far failed to locate other potential onshore sources, and Chile has turned to serious consideration of exploring certain offshore areas. In 1969, the Government approached the United Nations with a request for technical and financial assistance in a joint project involving offshore exploration of parts of the Continental Shelf off south-central Chile and parts of the Magellan Straits contiguous with producing onshore areas in Magallanes.

During 1968, Empresa Nacional del Petróleo (ENAP), the State-owned petroleum agency, continued its drilling and other exploratory work in Magallanes and Arauco Provinces and its geological studies of coastal areas between Matzanas in Santiago Province and Chanco in Maule Province, where the presence of ozokerite and other hydrocarbons have been noted in formations that extend into adjoining offshore areas. Two seismic crews working in Magallanes logged 262 kilometers of reflectivity and 302 kilometers of refractivity profiles. Drilling activity dropped sharply with completion of only 75 wells totaling 158,390 meters compared with 100 wells and 187,410 meters in 1968. Drilling completed during 1968 and 1969 is shown in the following tabulation:

Type of well	Number of completions			
	Petroleum	Gas	Dry	Total
1968:				
Exploration	1	1	15	17
Extension	1	1	12	14
Development	35	14	20	69
Total	37	16	47	100
1969:				
Exploration	2	2	15	19
Extension	1	3	8	12
Development	22	5	17	44
Total	25	10	40	75

A new petroleum field was discovered at Bandurria on the island of Tierra del Fuego about 10 kilometers southeast of Tres Lagos near the Argentina border. Three producing wells and one dry well were completed in this area. Another oil discovery was made on the island at Estancia Nueva, where one producing and two dry wells were completed. Gas was discovered by wells drilled at Filaret Norte west of Bandurria and at Kimiri-Aike on the mainland. In Arauco Province, ENAP completed its second successful gas well near Lebu, and the discovery well was reported to be producing fuel for a local electric powerplant. Two other wildcat holes completed near Lebu were abandoned, and another hole at Quinahue south of Lebu encountered noncommercial gas shows and also was abandoned.

ENAP reported gross withdrawal of natural gas increased 6.9 percent to a record of 263,790 million cubic feet,[15] with production almost equally divided between fields on the mainland of Magallanes and those on Tierra del Fuego. Posesión field (mainland) remained the largest producer, yielding 29.2 percent of the total, followed by Cullen (Tierra del Fuego) with 12.6 percent, and Daniel (mainland) with 8.4 percent. Approximately 93.4 percent of the total volume of gas withdrawn at Posesión was reinjected, while 93.6 percent was reinjected at Cullen and 84.4 percent at Daniel. Average reinjection for all fields was 69.7 percent of the gross withdrawal.

[14] Servicio de Minas del Estado. Estadística de la Mineria del Carbon de Chile, 1968, 37 pp.
U.S. Embassy, Santiago, Chile. State Department airgram A-314, Sept. 18, 1969, p. 3; A-310, Sept. 22, 1969, p. 20; and A-22, Jan. 21, 1970, encl. No. 1.

[15] Converted from cubic meters using a factor of 35.3145 cubic feet per cubic meter.

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The total volume of gas treated at gas-processing plants at Posesión, Cullen, and Manantiales (Tierra del Fuego) declined slightly, accompanied by a 4.6-percent decrease in the recovery of natural gas liquids. Exports of liquefied propane and butane (to Argentina and Uruguay) amounted to only 256,700 barrels, the lowest level since 1962, whereas imports of liquefied gas into other parts of Chile increased substantially to about 301,500 barrels.

The downward trend in utilization of Chile's large reserves of natural gas as a source of natural gas liquids for domestic and export markets is expected to reverse late in 1970 with the completion of a two-plant gas-processing complex at Posesión and Cabo Negro. Ishikawajima-Harima Heavy Industries of Japan was selected to supervise construction of the Cabo Negro facility and Fluor Corp. of Los Angeles will oversee installation of the new plant at Posesión. Cost of the complex, excluding new roads, pipelines, and certain other ancillary facilities, was estimated at $17 million.

Crude petroleum production in 1969 declined 2.5 percent to 13,349,776 barrels compared with the record output of 13,695,400 barrels achieved in 1968. Daily production averaged 36,575 barrels. The only major fields to register increased output were Daniel (3.4 percent) on the mainland and Calafate (32.7 percent) on Tierra del Fuego. Output decreased at all other fields, especially at Cañadón (11.7 percent) and Daniel Este on the mainland and at Catalina Sur (27.2 percent), Tres Lagos Sur, and Cullen on Tierra del Fuego. Note that high output levels at Cañadón and Catalina Sur fields during 1968 were largely responsible for the national production record set that year. With an output exceeding 2 million barrels, Calafate became Chile's most productive field for the first time. However, in terms of cumulative output, its total of 9.9 million barrels at yearend was far exceeded by that of Cullen field with nearly 30 million barrels and Daniel field with 18.9 million barrels. Fields on Tierra del Fuego increased their share of the total production slightly to 53.1 percent. A comparative table of production by field for 1968 and 1969 follows:

Location and field	Production (thousand 42-gallon barrels)	
	1968	1969
Mainland:		
Daniel	1,707	1,765
Daniel Este	1,469	1,391
Cañadón	1,498	1,323
Posesión	1,216	1,185
Others	615	593
Total	6,505	6,257
Tierra del Fuego:		
Calafate	1,539	2,043
Cullen	1,682	1,597
Catalina Sur	1,174	854
Tres Lagos	743	719
Others	2,052	1,880
Total	7,190	7,093
Grand total	13,695	13,350

Approximately 1.6 million barrels of crude from the Argentine Cerro Redondo and Condor fields was pumped through Chilean pipeline facilities to the ENAP maritime terminal at San Gregorio. ENAP collected 231,300 barrels of this crude as a toll for the service.

ENAP refineries continued to supply the major part of the liquid fuels consumed by Chile. The total volume of crude processed was 7.5 percent more than in 1968, but imported crude accounted for 53.5 percent of the 1969 total whereas Chilean crude provided nearly two-thirds of that processed in 1968. The Concón refinery near Valparaiso processed 15,989,500 barrels, of which more than 90 percent was of foreign origin; the Concepción refinery processed 12,422,700 barrels, most of which was Chilean crude; and the small topping unit at Manantiales processed 548,300 barrels of Chilean crude. The net production for sale of the two large refineries for 1969 was as follows:

Product	Net production (thousand 42-gallon barrels)	
	Concón	Concepción
Aviation gasoline	225	------
Other gasoline and naphtha	4,768	5,010
Kerosine	1,247	1,432
Distillate fuel oil	2,102	2,374
Residual fuel oil	5,724	2,024
Liquefied petroleum gas	507	1,466
Other, including solvents	361	------
Total	14,934	12,306

A new topping unit was being installed at the Concepción refinery during 1969 and was scheduled to go on stream about

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mid-1970. The additional unit will increase the refinery's total crude capacity from 36,000 to about 60,000 barrels per day. This expansion hopefully will enable ENAP to supply most of the rapidly increasing demand for liquid fuels with locally refined products.

During 1967–69, when both large refineries were in full operation, Chile's crude imports averaged about 13 million barrels per year, slightly less than the average output of domestic crude. Inasmuch as output of crude petroleum from known domestic resources apparently has leveled off at about 13 to 14 million barrels per year, Chile must increase crude oil imports substantially to provide the additional quantities required by the refineries in the near future. In the latter part of 1969, ENAP arranged to increase the import level to 20 million barrels per year. New contracts were awarded to subsidiaries of Standard Oil Co. (New Jersey), Gulf Oil Corp., and British Petroleum Co., Ltd., to supply a total of 100 million barrels of foreign crude during the 5-year period January 1970 through December 1974. British Petroleum will provide crude from the Middle East; Gulf will supply Colombian crude; and Standard's Esso International, Inc., will provide either Venezuelan or Middle East crudes in accordance with options retained by ENAP which permits it to regulate the relative amounts of various grades that may be required from time to time.[16]

[16] Empresa Nacional del Petróleo, Chile. Boletín Estadístico, Sección Tecnica, 4° Trimestre y Anual. V. 46, 1969, 60 pp.
World Petroleum Report, 1970. Chile. V. 16, 1970, pp. 62–63.

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The Mineral Industry of Mainland China

By K. P. Wang [1]

Mainland China continued to be an important mineral producer by world standards, with overall mineral output value establishing a record for the 1960's and slightly surpassing the 1966 level which was a previous high. At yearend 1969, the trend was up and the Chinese Communists were forecasting a very good year for 1970. The disastrous economic setback created by the Cultural Revolution was finally reversed, although many problems remained unsolved and capital construction and mine development programs still lagged.

The People's Liberation Army (PLA) played a vital role in maintaining law and order during the year. In 1968 it was given unprecedented access to management of the economy and dominated many Revolutionary Committees and Alliances which were created to stimulate production. Mao Tse-tung called in the PLA to fill the void left by the departing Red Guard students. Workers in industrial and mining centers were extolled, but there was still much confusion until the PLA stepped in. By late 1968, China's economy had finally regained some semblance of normality. However, factionism and anarchism persisted during the first half of 1969 and this held back industrial progress somewhat. One major confrontation took place between workers and PLA—in Taiyuan during July. To spur industrial production, a national emulation campaign was initiated at the Peking steelworks in mid-September and the idea was to use this enterprise as a success model for other industries and mines.

Mainland China's industrial policy for 1969, aimed at coping with both domestic and international pressures, was summed up in an editorial in the February 21 issue of People's Daily.[2] The basic concept was that "agriculture should be the foundation and industry the leading factor" in improving the economy. Accordingly, very large quantities of fertilizers were used, which helped to make 1969 a good crop year. Agriculture provided much capital for industrial development and was expected to do so on a larger scale in the future. In return, industry was gearing toward the needs of agriculture. Thus, large industrial enterprises stressed production of fertilizers, farm equipment, and special metal products, among other things. Many small mines and local industries were established throughout the country, including coal mines, fertilizer plants, hydroelectric power units, metal and machine shops, and cement plants. Overall, the Chinese were placing emphasis on industry along with agriculture and on small industries along with large mines and plants.

Early in the year, there was much fear of confrontation with the Soviets, Even the stockpiling policy in materials, which caused mineral exports to dwindle and mineral imports to expand greatly, may be related to this apprehension. Decentralization of industries, particularly with regard to construction of new and not-too-large mines and plants was stressed. On the other hand, not much could be done with the existing large mines and plants, except to proceed cautiously, complete unfiinished facilities, and maximize production. Sino-Soviet relations thawed considerably around October 1, the National Day, and while tension may have eased somewhat, the policy of decentralization no doubt would continue.

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[1] Supervisory physical scientist, Bureau of Mines, Washington, D. C.

[2] Far Eastern Economic Review. 1970 Yearbook (Hong Kong). 1970, pp. 97–115.

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Viewing the Chinese economy from a regional basis, there were many claims of industrial achievements in specific provinces and cities. Almost all the claims show very great increases over those in 1968, in terms of industrial output value. Large parts of the added value were related to greater sophistication of industry and wider variety of products, but there were also sizable increases in absolute tonnages of basic materials. According to the Chinese Communists, Liaoning Province's industrial output value was up more than 50 percent over that of 1968; this encompasses China's "Ruhr" with many famous industrial and mineral enterprises. Heilungkiang Province also showed an advance of similar magnitude; this province has many large coal mines and Taching, the country's premium oilfield. The city of Peking with the steelworks of the same name and the famous anthracite fields was said to have topped its previous industrial output by a third. Tientsin with many light and heavy industries reportedly topped the 1968 production level by 28 percent. Shanghai more than achieved projected State plans. Hopeh Province with many big coal mines and other industries also increased production considerably. Kansu with its oilfields and refineries established a production record. Even discounting exaggerations, it is evident that 1969 was a much better industrial year than 1968 for China and output value was at an historic high.

Petroleum spearheaded mainland China's industrial recovery. The Taching oilfield in Heilungkiang, Manchuria, by far the largest in the country, pushed crude production up by possibly 37 percent over that in 1968. The local refinery, although still only able to handle possibly one-third of the crude, was greatly expanded. Except for the temporary cutback caused by the Cultural Revolution, Taching has experienced uninterrupted rapid growth into a medium-sized oilfield by world standards. Production at the old and much smaller Yumen oilfield in Kansu Province was raised considerably. Performance at Karamai in Sinkiang Province was not as noteworthy but still good. The old shale oil center of Fushun was once more producing near capacity now that a third refinery had been built specifically to handle crude oil from Taching leaving the other two refineries to process local shale oil. Construction at China's second oil center, Mowming in Kwangtung Province, was reportedly progressing favorably.

China's coal industry, third ranking in the world, went through a very peaceful and productive year. By all indications, output was a record for the 1960's. Most of the big mines were mentioned in the press as having overfulfilled their 1969 targets, including the seven combines which topped 10 million tons—Fushun, Fuhsin, Kailan, Tatung, Huainan, Chihsi, and Hokang. Indications were that the relatively new Pingtingshan enterprise may soon be joining this select circle.

Except for an incident in Taiyuan, all the leading steel centers had good years. Anshan in Liaoning Province, Manchuria, a large steelworks by world standards and the backbone of China's steel industry, produced at a record pace; its products clearly became more varied and sophisticated. Wuhan in Hupeh Province became a sizable integrated operation, with the installation of the third blast furnace, a large open-hearth furnace, and additional processing facilities. The Peking combine near the capital was streamlined as a result of the emulation campaign mentioned. Among the smaller leading centers, Taiyuan started to operate its two Austrian basic-oxygen furnaces, Paotou completed a large rolling mill, Penhsi became more diversified, and Maanshan greatly expanded iron ore operations. Various steelworks in the city of Shanghai installed additional converters and used more steel scrap.

The only bright side of nonferrous production seems to be a notable increase in aluminum output but this was from a small production base. A drive in electrification pushed up the demand for both aluminum and copper. The significant news in copper, lead, and zinc concerned purchases from abroad rather than expansions in output. China's well-known export metals like tin, tungsten, antimony, and mercury were not available for sale in large quantities at either the Canton Fairs or elsewhere. These happenings might suggest reduced production but it is more likely that stockpiling, spiraling of prices, and the war-scare contributed more to this apparent policy of holding back sales. Output and exports of nonstrategic nonmetallics were not affected by the emergency situation.

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The shortage of fertilizers and raw materials was met by expanding domestic production together with increasing imports. The building of many small fertilizer plants and hydroelectric plants were significant trends. Late in September, two underground nuclear tests, of which at least one was of the fusion type, were made on mainland China.

PRODUCTION

Industrial and mineral production was sluggish in the first half of 1969 and high in the second half, both levels surpassing considerably the corresponding levels in 1968. Although no nationwide claims for major production items were known to have been made, and the Chinese never disclose many items anyway, numerous claims for areas and enterprises have been reported. One nebulous claim was that petroleum production in 1969 reached several times the amount in 1965. This is meaningless until some specific claims by the leading oilfield—Taching—are examined; achievements at Taching clearly imply that the country's oil output conceivably could have doubled in this interval. According to the Chinese, many large coal mines overfulfilled their 1969 targets and for quite a number the days ahead of schedule were also given. Overall coal output can thus be judged from components. In steel, Anshan has nearly the same predominant position as Taching in oil. This steel center topped its 1969 targets and reportedly established a "historic" output record, at least for the first third of the year. Several major salt fields were said to have fulfilled output goals before the fall, leading to the conclusion that a very high level was achieved nationwide. There was sufficient news on construction trends and specific plants to suggest a fairly good year for cement production. The fact that China's famous export metals were little sold in world markets makes it difficult to substantiate estimates, except on the basis of previous performance.

TRADE

Overall trade of mainland China, never much of a trading country, showed a slight upturn over 1968. The bulk of the 1969 trade was again with the free world countries, principally Japan and Western Europe; trade with Communist countries remaned unimportant and the impasse with the Soviet Union showed no improvement. Minerals and metals remained significant in total trade, with exports down and imports up. Much of the mineral-related trade with the outside world involved export of traditional surplus commodities—special nonferrous metals, coal, salt, fluorspar, and other nonmetals, and import of large quantities of fertilizers, sizable tonnages of metal products, and some industrial and mining equipment.

Business at the fall Canton Trade Fair was brisk as compared with the spring fair, with the two-way volume reaching just under $1 billion. Unlike the pattern of recent years, imports surpassed exports considerably. The Chinese were very interested in steels, nonferrous metals (particularly copper, lead, zinc, aluminum, nickel, and platinum), fertilizers, chemicals, machinery, and trucks and bulldozers. The Europeans might have sold more, if they had more to offer; in contrast, the Japanese did rather well. The Chinese export availabilities remain lower than anticipated. Sales of antimony, tungsten, tin, and mercury were small, and no molybdenum or bismuth were offered.

The Chinese contracted to buy possibly 1.5 million metric tons of steel products from the Japanese in 1969, valued at more than $250 million. Fertilizer contracts with Japan probably topped 3.5 million tons and $100 million. Steel and fertilizer imports from Western Europe also were substantial. A metallurigical plant of unknown type was contracted from West Germany, which in recent years has sold China various kinds of machinery and industrial equipment. The United Kingdom had contracted to sell an Imperial Smelting Process (ISP) nonferrous smelter some time ago. U.K. exports of copper, lead, and platinum became important. During the first 11 months of 1969, nonferrous metal exports from the United Kingdom to China totaled about $55 million including $21 million worth

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Table 1.—Mainland China: Production of mineral commodities e

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Aluminum:			
Bauxite [1]	350,000	380,000	450,000
Alumina	175,000	190,000	230,000
Metal, refined	80,000	90,000	120,000
Antimony, mine	12,000	12,000	12,000
Bismuth, mine	250	250	250
Copper:			
Mine	80,000	90,000	100,000
Metal, refined	90,000	100,000	100,000
Gold, troy ounces	50,000	50,000	50,000
Iron and steel:			
Iron ore [2], thousand tons	28,000	38,000	40,000
Pig iron, do.	14,000	19,000	20,000
Steel ingot, do.	11,000	15,000	16,000
Rolled steel, do.	9,000	12,000	13,000
Lead:			
Mine	90,000	100,000	100,000
Metal, refined	90,000	100,000	100,000
Magnesium	1,000	1,000	1,000
Manganese ore, thousand tons	700	900	1,000
Mercury, 76-pound flasks	20,000	20,000	20,000
Molybdenum, mine	1,500	1,500	1,500
Silver, troy ounces	600,000	700,000	800,000
Tin, refined, long tons	20,000	20,000	20,000
Tungsten concentrate, about 68 percent WO_3	15,000	15,000	15,000
Zinc:			
Mine	90,000	100,000	100,000
Metal, refined	80,000	90,000	90,000
NONMETALS			
Asbestos	150,000	150,000	160,000
Barite	100,000	120,000	140,000
Cement, thousand tons	8,000	9,000	10,000
Fluorspar	250,000	250,000	250,000
Graphite	30,000	30,000	30,000
Gypsum	500,000	500,000	550,000
Magnesite, thousand tons	800	900	1,000
Phosphate rock, do.	1,000	1,000	1,100
Pyrite, do.	1,500	1,500	1,800
Salt, do.	13,000	15,000	15,000
Sulfur	250,000	250,000	250,000
Talc	150,000	150,000	150,000
MINERAL FUELS AND RELATED MATERIALS			
Coal, thousand tons	225,000	300,000	330,000
Coke, do.	13,000	15,000	17,000
Petroleum:			
Crude, do.	11,000	15,000	20,000
Refinery products, do.	10,000	14,000	19,000

e Estimate.

[1] Mostly diasporic bauxite. Data shown include only the bauxite for aluminum manufacture; in addition 100,000 to 200,000 tons was produced each year for making refractories.

[2] Converted to equivalent 50 percent Fe ore.

of copper, both more than double the 1968 level. During the fall Canton Fair, the Chinese showed interest in Canadian nickel and copper; previously, substantial tonnages of Canadain zinc had been imported. Judging from reduced sales of China's traditional export metals and increased purchases of metals that are in short supply, it has been suggested that many materials were being stockpiled for an emergency.[3]

COMMODITY REVIEW

METALS

Aluminum.—The apparent big push in electricity generation and transmission, both in the industrial areas of the east coast and in rural districts around the country, has greatly increased the demand for aluminum. China was trying to buy more copper and aluminum from abroad, in addition to expanding aluminum production internally, in order to meet all her present needs. It is evident that the country's annual output of aluminum has topped the 100,000-ton level considerably, and various

[3] Wall Street Journal. Jan. 26, 1970, p. 1.

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new plants have been commissioned recently to supplement Fushun in Manchuria, previously the only reduction plant of consequence. One source[4] reports "soaring output at a Sanmen Gorge aluminum plant." Kirin Province, apparently has a new aluminum plant in Changling County, about 100 miles west of Changchun. Small aluminum plants have reportedly been built in Honan (near Chengchow) and Hupeh Provinces.

Antimony.—China retained its position as the world's leading antimony producer, with an estimated output level on a par with that of 1968. The Hsikwangshan district in Hunan Province was still the main source, followed by Kwangsi Province in distant second place.

Increased demand for use in electric vehicles and by the atomic energy program and the overall policy to stockpile raw materials, resulted in the Chinese not selling much antimony during the Canton Fairs of 1969. World prices also were increasing radically; for example, a pound of antimony sold for 44 cents in the United States early in 1969, as compared with $3.50 per year later, with the shortage of Chinese material no doubt contributing to this price increase. Nonetheless, the Japanese still managed to import 2,628 metric tons of 60 to 65 percent antimony concentrates from China during the first 11 months of 1969, priced initially at about $7 per unit (but presumably priced higher subsequently), with Hibino Metal Industries as the sole contractor.

Bismuth.—Mainland China has long been an important bismuth producer, usually contributing 5 to 10 percent of the world total. Traditionally, the bulk of the bismuth, found in association with tungsten and nonferrous metals, has been exported. At the 1969 Canton Fairs, however, only small amounts of Chinese bismuth were offered for sale.

Cadmium.—China's small output of cadmium has been supplemented by a moderate supply from North Korea. Prior to midyear, a combined surplus existed, with the Chinese even offering 90 tons for sale during the spring Canton Fair. In subsequent months, a serious shortage developed and the Chinese turned around to buy 100 tons at high prices. It may be that North Korean deliveries declined whereas requirements shot up because of the increased need for batteries and solders for electric equipment and vehicles.

Copper.—The acute shortage in copper continued because of large demands in power and other industries. Imports totaled at least several tens of thousand tons annually. Much copper and copper alloys have been purchased abroad through the London Metal Exchange, including about 12,000 tons from the United Kingdom during the first 10 months of 1969. This shortage had prompted the country to utilize more aluminum and to make special efforts to explore for copper. Several sizable porphyry copper deposits reportedly had been found in North China, although there was still no news of large-scale mining. New smelters for processing such ores were not in existence, and inquiries to buy smelting facilities from the Japanese did not result in purchases. One "backward medium-sized mine"—Hungtoushan in Manchuria near or in Fushun—was supposedly built into "an advanced big enterprise" through the sinking of a new vertical shaft.[5] Reportedly, the 1969 target for this mine was achieved 34 days ahead of schedule and output was 71 percent above the previous peak established in 1968. The small Shenyang nonferrous smelter in Manchuria, mainly a refiner of copper, was operating normally again.

Iron and Steel.—Output clearly topped 1968 levels and may have surpassed 1966 levels, the high point in the 1960's. Although ill effects of the Cultural Revolution may have been finally surmounted, there seemed to have been a production lull in the middle of the year, possibly because of war-scare dislocations. Provided political and/or military events do not create undue hardships, 1970 looks like a year of record steel output.

The Cultural Revolution had brought mainland China's program to obtain foreign steel plants and know-how to fill the technical void created by the Sino-Soviet rift to a virtual halt. The Chinese were trying to build from within, and disseminate what little foreign technology obtained into prototype operations. A number of BOF's were built, including a socalled "rotating" one possibly at the Shanghai

[4] New China News Agency, (Peiping). Aug. 24, 1969, p. 1.
[5] New China News Agency (International Service in English; Peiping). Dec. 31, 1969, p. 1.

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No. 1 steelworks, which could well have been copied from the two Austrian converters at the Taiyuan steelworks. The Chinese may be following up on negotiations to purchase a West German steel plant, but their capability to purchase is rather limited.

Conforming to a general policy of buying all kinds of materials for stockpiling, the preference appears to be in acquisition of finished steel products. The fact was that mainland China imported (or rather Japan exported) roughly 1.2 million metric tons during 1969, mostly of the difficult-to-make types, such as large tubes and pipes, tinplate, hot and cold rolled sheet and coil, and special steels. Contracts show that transactions with Japan in 1970 will be considerably higher. Smaller but similar imports also came from Western Europe. Thus, perhaps a sixth of the steel product supply of mainland China came from abroad.

In addition to progress in making a greater variety of steel products, such as more complicated shapes and alloy steels, mainland China also did better in manufacturing steelmaking equipment. The Chinese have known how to construct blast furnaces and open hearths for some years. Now they can build oxygen converters, simpler types of rolling mills, galvanizing plants, and automatically controlled electric furnaces. At yearend, a large (700-ton) sintering machine was successfully produced on a trial basis. Greater use of sophisticated equipment may explain in part why more steel scrap was consumed.

Anshan in Liaoning Province, Manchuria, a large integrated steel center by world standards with 10 blast furnaces ranging in size from 585 to 1,513 cubic meters and 25 open hearths, probably produced about 6.5 million metric tons of steel ingots—a historic record. Anshan reportedly fulfilled the 1969 output targets for iron, steel, rolled steel, iron ore, and coke.[6] Technically, numerous advances were reported, including trial manufacture of several hundred new products. Many large structural shapes also were produced. The seamless tube mill did particularly well, with output registering a notable increase, especially in large diameter tubes. Some special tubing was made for a new oil refinery. A medium-size rolling mill fulfilled its 1969 production quota several months ahead of schedule. A big new iron mine at nearby Chita Mountain was completed within the year, greatly increasing overall ore production. The Kungchangling mine more than met its 1969 target.

Prior to 1969, the Wuhan steelworks in Hunan Province had two blast furnaces (one, 1,386 cubic meters and the other 1,436 cubic meters); five open hearths (four 500-ton and one 250-ton); three byproduct coke plants; and various rolling mills, including a heavy mill for making rails, girders, I-beams, etc. On April 9, 1969, a third large blast furnace ("70 meters" high) was commissioned, and on December 16 another large open-hearth furnace probably of a 500-ton size went into operation.[7] These two latter facilities built by the Chinese without Soviet help, brought capacity for the Wuhan steelworks up to possibly 2.2 million metric tons of crude steel per annum. Actual steel output in 1969 was estimated at 1.7 million tons. Apparently, additional rolling and other processing facilities were in the process of construction or being planned. A large underground iron mine—Chengchao—was brought into production near yearend to provide ore for the steelworks.[8] Wuhan had experienced many political disturbances and, in fact, some outright fighting in 1967–68, but things settled down under the local Revolutionary Committee by 1969, enabling the steelworks to resume normal operations in production and basic construction.

The Peking or Capital steelworks, a merger of Shihchingshan and other plants in the municipality of Peking, spearheaded an "emulation drive" to spur production by steel and other industries. Output increased, with 1969 targets attained ahead of schedule and product value reported as nearly twice that of the previous year.[9] With the completion of a new blooming mill in September, the Peking steelworks became much more integrated, although some ingots and semimanufactures were still sent to Tientsin and Tangshan. Facilities included three blast furnaces (413, 512, and 963 cubic meters), three coke units, sinter-

[6] New China News Agency (International Service in English; Peiping). Dec. 30, 1969, p. 1.
[7] New China News Agency (International Service in English; Peiping). Dec. 22, 1969, p.1.
[8] New China News Agency (International Service in English; Wuhan). Nov. 8, 1969, p. 1.
[9] New China News Agency (International Service in English; Peiping). Dec. 26, 1969. p. 1.

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ing plants, top-blown oxygen converters, and rolling mills. Annual steel capacity seems to be on the order of 1.5 million tons, although the Chinese imply planned capacity at more than double this. A new iron mine was nearly on stream, "creating conditions for a new leap forward in iron and steel production next year."

Shanghai, with at least eight small steel plants, did well in 1969 and combined ingot output is conservatively estimated at 1.5 million metric tons. Apparently, some plants further processed iron materials supplied by the Maanshan steelworks in nearby Anhwei. Scrap was also an important raw material, and various drives were made to obtain enough for use. Shanghai No. 1 was the most important steelworks, with its two 255-cubic-meter blast furnaces, two 70-ton open hearths, about five 8-ton Bessemer and Thomas converters, possibly three 30- to 35-ton "homemade" oxygen top-blown converters (the last one placed in production on September 27, 1969), a slabbing mill, a medium plate mill, and a forging mill, among other facilities. The Shanghai No. 3 steelworks continued to stress the manufacture of steel and products, reporting fairly high production levels; the second converter shop was commended for good performance, electric furnaces were placed in operation, and a large-size "Regino" plate mill was installed. Another Shanghai plant successfully made "trace carbon pure iron" in an electric arc furnace.[10]

The Maanshan steelworks in Anhwei Province became nearly fully integrated, with the completion of the second rolling mill unit in the fall. Previously, Maanshan had 13 small blast furnaces ranging from 34 to 225 cubic meters in size, two open hearth shops, possibly five small converters, and a heavy rolling mill. Efforts were made to achieve raw material self-sufficiency by greatly expanding iron ore extraction at the Kungshan, Taochung, and Nanshan mines, among others.[11] Much was said about streamlining the No. 1 sintering works and on how important it was for conditioning ore prior to smelting. Many improvements were made in the technical area, as for example the introduction of electronic-controlled automation for the feeding of raw materials to one of the blast furnaces. A large rolling mill was reportedly manufactured by the equipment division of the steelworks. Maanshan was said to be producing at a rate considerably higher than in 1966 and a third greater than designed capacity. During 1969, Maanshan may have produced 700,000 to 900,000 tons of pig iron and steel, with some surplus of crude metals going to the steel plants in Shanghai.

The Taiyuan integrated steelworks in Shansi Province was substantially completed by 1969, after two 55-ton Austrian Linz-Donowitz (LD) furnaces BOF's were placed in operation early in the year and the No. 2 rolling mill started normal production late in the year. Previously, five blast furnaces (one 963 cubic meters and the other, 291 cubic meters plus three smaller ones), some open-hearths and electric furnaces, and the first rolling mill had been installed. The Cultural Revolution, precipitating a brief "seizure" in 1967, had interrupted basic construction, but 1968 was peaceful and 1969 turned out to be a year of progress despite an "incident" late in July. This center may have produced a million tons of steel ingots in 1969.

The Paotou steelworks in Suiyuan Province finally became fully integrated with the completion of a large rolling mill early in the year. Previously completed facilities included a 1,515-cubic-meter blast furnace, a sintering plant, byproduct coke plants, possibly two 600-ton open hearths, and supporting iron and coal mines, refractory plants, and machine shops. Paotou's annual steel ingot capacity may be roughly 800,000 metric tons. Much has been written about the new, large shape rolling mill, which is capable of making rails, girders, and alloy steel I-beams.[12] At least some, if not most, of the basic equipment was what the Soviets provided 10 years ago but did not erect. Thus, the Chinese were very proud of their achievement. The Paotou steelworks was functioning smoothly, after a year of strife in 1967 and mediocre year in 1968.

The Chungking steelworks in Szechuan Province with three blast furnaces (620, 134, and 55 cubic meters) and at least two open-hearth workshops—one large and one small—may have a combined capacity of

[10] Jen-min Jih-pao (People's Daily; Peiping). Apr. 9, 1969, p. 1.
[11] Hofei Anhwei Provincial Service (in Mandarin; Hofei). Dec. 12, 1969, p. 1.
[12] China Reconstructs (Peiping). August 1969, pp. 16–19.

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800,000 tons of steel ingot per year. A somewhat outmoded plant, Chungking apparently did well in the spring and one of the open-hearth furnaces reportedly was turning out steel at a record rate of 4.5 hours per heat.

The Penchi (Penhsi) complex of several dozen mines and plants became fairly integrated in recent years, with the addition of rolling mills and new steel furnaces, mostly electric, to complement the iron, coal, and refractory mines, the coke ovens, and the blast furnaces. The year's quota was fulfilled, and output value was considerably higher than a year earlier,[13] because of the additional processing facilities brought into operation. The No. 2 blast furnace was reportedly overhauled. The Penchi steelworks in Liaoning Province was about the size of Paotou, Chungking, or Maanshan.

Many small iron and steel plants were in the news. The Canton (or Kwangchow or Shaokuan) steelworks placed in operation a third blast furnace and the first top-blown oxygen converter to complement small rolling mills. The Tangshan and Tientsin plants were probably using scrap in addition to iron materials from the Peking steelworks. The Hantan steelworks in Shihchiachuang, Hopeh Province has been developed into a medium-size complex. The Kunming (Anning) steelworks in Yunnan Province added modern coke ovens to rolling and other facilities. An oxygen converter was commissioned at the Lienyuan steelworks in Hunan Province. The Nanking steelworks in Kiangsu Province was expanded. A new steel plant was being built in Sian, Shensi Province. There is a small complex in Hungshih (called Tungnan), Kirin Province with various facilities, including two blast furnaces and rolling mills. The Tahsing steelworks in Hangchow, Chekiang Province, built its third mechanized coking battery rated at 40,000 tons of coke per annum. There are small steel plants in Pinghsiang and Fengcheng, Kiangsi Province, and at several places in Heilungkiang Province. Hanyang near the Wuhan steelworks has rolling mills, and Tsingtao has a steel tubing products plant. The Nanchang plant has electric furnaces. Other plants include Hofei and Anhwei, Kweiyang in Kweichow, Wuhsi in Kiangsu, Tsinan in Shantung, and Sining in Tsinghai.

Lead and Zinc.—The contract signed with the British to build an ISP plant at Shaokuan in northern Kwangtung was apparently not yet implemented by 1969 because of internal confusion. Originally, the plan was to produce 35,000 to 40,000 tons of zinc and 18,000 to 20,000 tons of lead annually.

The well-known but old Shuikoushan lead-zinc mine in Hunan Province reportedly has been converted into a modern operation and was doing well in late 1968.[14] The old Chingchengtzu lead-zinc mine near Fushun, Liaoning Province was said to have surpassed its 1969 target by a wide margin. There has been no mention, however, of significant new lead-zinc finds in the press since the Chinese Communists assumed power.

Meanwhile, demand for these metals has gone up and sizable tonnages of imports have become necessary in recent year. Zinc is needed in galvanizing and making alloys, and lead is needed principally for batteries and cables to support the transportation and electrical industries. The Chinese purchased considerable lead on the world market during 1968–69, including about 19,000 tons in 1968 and about 31,000 tons from the United Kingdom alone during the first 9 months of 1969. During 1968 Canada furnished about 15,700 tons of zinc, and Japan nearly 5,000 tons. North Korea probably also has been supplying sizable tonnages of lead and zinc to China.

Magnesium.—China's small output of magnesium still comes from an old Japanese plant in Manchuria. Efforts to get the Furukawa Magnesium Co. of Japan to build a new plant in China have not been successful.

Manganese.—Mainland China's manganese ore production returned to the million-ton level in response to a greater demand from expanded steel smelting operations. Hsiangtan in Hunan, Mukwei and Leiping in Kwangsi, Chin Hsien and Fangcheng in Kwangtung, Tsunyi in Kweichow, and Wafangtzu in Manchuria were the main producers. A new mine was reported—Chienchi in Chihsiashan near Nanking. about 15,000 to 20,000 tons of Chinese manganese ore went to Japan during the year.

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[13] New China News Agency (International Service in English; Peiping). Dec. 27, 1969, p. 1.
[14] Ta-kung-pao (Peiping). Sept. 1, 1968, p. 1.

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Mercury.—Although mercury output was considerably below peak levels, China was still prominent among world producers. Southwest China, particularly Tungjen in Kweichow, produced the bulk. In the early 1960's exports were very substantial, as for example when 35,000 flasks were shipped to the Soviet Union in 1962. Many countries now import mercury from China, but in small quantities. Consumption has gone up, although stockpiling may be the main reason why only a small amount of Chinese mercury has been entering world markets.

Molybdenum.—Existing small mines have been producing surpluses for export. Poland, for example, took 101 metric tons of molybdenum concentrates from China during 1968. Several large molybdenum deposits have not been fully developed.

Tin.—Chinese tin output was at one time substantial, as attested by large exports, principally to the Soviet Union, and a known high level of demand within China. Official Soviet trade returns, however, have shown only nominal transactions in recent years. Free world imports of tin from mainland China have also declined from 5,000 to 7,000 tons annually in 1962–65 to only about 3,000 tons in 1967–68 and apparently even less in 1969. Yearly tin consumption in China has been estimated at 5,000 to 7,000 tons. Facilities for making tinplate are still inadequate, and large purchases have had to be made from Japan and elsewhere. For 1969, combined tin output from the two tin centers of China—Kuchiu in Yunnan and Fuhochung in Kwangsi—has been estimated at 20,000 tons. A new placer tin mine—Chiumou in Kwangi reportedly was placed in production.[15] Apparently, considerable tin has been stockpiled in the last few years. Japanese merchants believe that Chinese tin exports may soon again attain high levels.

Titanium.—Although unable to produce metal, the Chinese are on the verge of making titanium dioxide as a chemical plant in Nanking apparently developed the necessary local manufacturing equipment. Hitherto, titanium ore was exported in exchange for the pigment, titanium dioxide. Japan has been the main source of titania (TiO_2), having supplied 3,077 tons in 1968 but only 525 tons during the first 11 months of 1969.

Tungsten.—Despite advancing prices, Chinese exports of tungsten declined in recent years with the pattern of outlet changing from predominantly Communist countries to free world countries. The Soviet Union imported nearly 19,000 metric tons of Chinese concentrates (containing possibly 10,000 tons of tungsten) in 1960, but only nominal amounts in 1967–69. In contrast, free world imports rose to a maximum of about 9,000 tons of concentrates by 1966, followed, however, by a decline to roughly 7,000 tons in 1967 and perhaps 5,000 tons in 1968 and 1969. Among free world countries, Austria, West Germany, France, Japan, and the United Kingdom have been the leading importers.[16]

For the past 5 years tungsten production by mainland China, mainly wolframite from Kiangsi Province, has been estimated at about 15,000 metric tons of concentrates or roughly 8,000 tons of tungsten content annually—some 25 to 30 percent of world output. More than three-quarters of the 1966 estimated Chinese output was exported, but the accountable proportion sold abroad has since declined to well below half that total. This suggests more stockpiling and holding back in anticipation of higher prices. Within the last quarter of 1969, European prices jumped 50 percent to about $70 per short ton unit. Large sales of tungsten concentrates at the fall Canton Fair did not materialize. Instead, the Chinese were trying to sell small lots of low-grade materials at unreasonably high prices.

Uranium.—Mainland China made at least two underground nuclear tests during the year, the first on September 23, 1969, and the second on September 29 that was claimed to be of the fusion type.[17] Previously on December 27, 1968, China tested its second hydrogen bomb in the wasteland of Lap Nor, Sinkiang Province; uranium-235 rather than plutonium was used to set off fusion. The uranium-235 was processed at a gaseous diffusion plant near Lanchow in Kansu. China's uranium ore came in part from Maoshan and Chusan in Chuannan County of Kiangsi Province and Hsiachuang in Weiyuan County of Kwangtung Province. A beneficiation plant has been built at

[15] New China News Agency (International Service in English; Peiping). Nov. 26, 1969, p. 1.

[16] Tungsten Statistics. United Nations, UNCTAD Committee on Tungsten (Geneva). Oct. 1969, pp. 1–68.

[17] New China News Agency (International Service in English; Peiping). Oct. 4, 1969, p. 1.

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Chuchou, Hunan Province. The Chinese have also been working on warhead devices. Not all was smooth in the nuclear field, however, in that nuclear research was seriously hindered as a result of political purges of scientists at the turn of the year 1968–69.

NONMETALS

Asbestos.—Mainland China probably ranked within the first five world producers of asbestos in 1969, providing possibly 4 percent of the world total. Production of asbestos—mainly long-fiber, chrysotile type—most likely surpassed the 150,000-ton level for the first time. The bulk of the output came from Shihmien in Szechuan, where a dozen new projects were completed in recent years, and a new large and high-grade ore body was reportedly discovered. China has been a small exporter of asbestos, and Chinese and Canadian asbestos experts have exchanged visits in the past.

Barite.—Barite production apparently reached a new high in 1969 because of the accelerated domestic oil drilling program. China's output already represented 2 to 3 percent of the world total, and the barite industry has good potential for further expansion. Rising demand, however, has cut export availability. Japan, historically the largest purchaser of Chinese barite, took only 16,080 metric tons in 1969, compared with three times this tonnage as a yearly average during 1966–67. Poland had been importing close to 10,000 tons annually during 1967–68.

Boron Minerals.—A surplus of borax continued although no specific information was available on the extensive boron-bearing lake deposits in the Iksaydam area of Tsaidam, Tsinghai Province. Possibly 4,000 tons of Chinese sodium borate went to Japan during 1960.

Cement.—Mainland China's cement production recovered to the 10-million-ton output level in 1969 and seemed to be heading for a record. The economic disruptions of the Cultural Revolution were finally shaken off, and construction activities picked up momentum. Compared with 1967 and 1968, many more cement plants were mentioned in the press.

As of yearend 1969, the country's cement industry primarily consisted of 50 to 60 large- and medium-sized plants of 100,000-ton to 1-million-ton annual capacity, and several hundred very small plants. The World Cement Directory[18] for 1965 lists then-known Chinese plants and most recent data on their capacities. Up to a dozen medium to big plants have since been constructed. Some of the medium to large plants built in various provinces during the 1960's were Tatung in Shansi; Kunming in Yunnan; Yao Hsien in Shensi; Yungteng in Kansu; Chungking in Szechuan; Kwangchow in Kwangtung; Liuchow in Kwangsi; Kweiyang in Kweichow; Mutanchiang and Tungchiang in Kirin; Nanping in Fukien; Huangshih in Hupeh; and Tungfanghung (Nanking) in Kiangsu.

The largest and newest cement plant is Hantan (south of Shihchiachuang) in Hopeh, rated at possibly 1-million-ton annual capacity. The Yao Hsien and Huahsin (Hupeh) plants are nearly as large. The maximum size of individual rotary kilns was reported at 300,000 tons. Two large cement plants with long histories—Fushun and Chihsin—apparently topped their production quotas. A medium-size plant—Nanchang in Kiangsi—also surpased its 1969 target. The Tungfanghung cement plant in Nanking was expanded to about 400,000 tons. The 270,000-ton Kaiyuan cement plant in Yunnan officially went into production December 26, 1969. The Chaohu cement plant in Hofei, Anhwei returned to normal production during the year, as did many other plants.

Diamond.—Changte in the Yuangchiang Basin of western Hunan is the only diamond mine known to have been worked in China. Reportedly, diamond deposits have also been found in Kweichow and Shantung Provinces. Commercial production of synthetic diamonds apparently commenced at a metallurgical plant in Tsingtao, Shangtung in mid–1968.[19]

Fertilizer and Chemical Materials.—During 1969, mainland China produced perhaps 7 to 10 million metric tons of processed fertilizers, all nitrogenous except for possibly two million tons of chemical and ground phosphates. Most output was ammonium sulfate, although urea and super-

[18] World Cement Directory (CEMBUREAU; Paris). European Cement Association. 1965, pp. 64–67.

[19] New China News Agency (International Service in English; Peiping). July 23, 1968, p. 1.

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phosphates were also produced. Much emphasis has been placed on small fertilizer plants in recent years, and hundreds have already been built. In fact, small plants account for more than a third of national capacity. Nanking, Kirin, Chuchow, Luchow, Hopeh, and Canton were among the newer large plants.

Even with increasing capacity, mainland China needs far more fertilizer than it can produce. Apparently, the country contracted to purchase some 5.5 to 6 million metric tons of chemical fertilizers in 1969 for future delivery, roughly the same amount as the year before. The Japanese tonnage contracted probably topped 3.5 million tons valued at well over $100 million. Actual Japanese trade returns covering past periods showed the following, in thousands of metric tons: 1968—ammonium sulfate, 747; urea, 655; and ammonium chloride, 335; and 10 months of 1969—ammonium sulfate, 572; urea, 645; and ammonium chloride, 324. European contracts made in 1969 for future delivery, all through a consortium called NITREX, totaled 2.2 million tons or thereabouts. Mainland China also imported 533,500 metric tons of phosphate rock from Morocco during 1968 and 480,600 tons during the first 9 months of 1969. The Canadians have been trying to sell potash but with no success. East Germany, however, shipped 2,000 tons of potash to mainland China in 1969 for testing purposes.

Pyrite production probably increased substantially during the year on account of requirements for making sulfuric acid and fertilizers. Most output presumably came from Hsiangshan in Anhwei and Yingte in Kwantung. Additional pyrite was produced in Szechuan and Shansi Provinces, but output is not included in usual estimates since this pyrite is converted to about 250,000 tons of elemental sulfur annually, a part of which is ultimately exported. A "large, mechanized sulfur refining furnace" was designed and built by the Kansu Metallurgical Co.[20] Byproduct sulfur from nonferrous ores was also used to some extent in sulfuric acid manufacture.

Phosphate rock production in 1969 most likely surpassed the 1-million-ton mark for the first time, coming mainly from Chinghsiang in Hupeh, Kaiying in Kweichow, and, to a lesser extent, Liuyang in Hunan and Nantung in Kiangsu. Mainland China not only imported phosphate rock, but also some apatite from Laokay, North Vietnam.

Fluorspar.—Chinese fluorspar production was perhaps 7 percent of the world total. Output from Chekiang and North China remained steady, but Kwangsi Province has become a significant new source. The bulk of the flourspar has been traditionally exported. During 1968, importing countries gave the following figures, in metric tons: Japan, 111,240 (121,944 tons in 1969); U.S.S.R., 31,000 tons in 1968; Poland, 20,782; West Germany, 28,654; the Netherlands, 7,819; Sweden, 4,031; and Belgium, 1,883. The Kamaisho Co. of Tokyo was the sole Japanese contractor for fluorspar imports from mainland China. During the autumn Canton Trade Fair of 1969, Japan contracted to buy 40,000 metric tons of fluorspar valued at $1.5 million.

Magnesite.—Southern Manchurian magnesite, found in a belt extending from Tashihchiao northeast to Lienshankuan in Liaoning Province, continued to be of great world significance. With the steel industry fully recovered from the debacle of the Cultural Revolution, magnesite output in 1969 probably returned to the 1-million-ton level. Anshan steelworks has pioneered the use of magnesia-alumina bricks for steel smelting in China. Large amounts of magnesite and calcined magnesia have been traditionally available for export but not too much has been actually exported in recent years.

Salt.—Mainland China retained its position as the second largest world producer of salt, after the United States. Apparently, 1969 output was about the 1968 level—a historic record. Operating conditions were good for the four main coastal sea salt-producing provinces—Kiangsu, Shantung, Hopeh, and Liaoning. Tangku, the main field in Hopeh Province, probably fulfilled its 1969 target by August; Liaoning Province reportedly attained its 1969 output quota by September; and the Yingko field on Hainan Island, also sea salt producing and the biggest in South China, met its goal 4 months ahead of schedule possibly because a new salt-collecting machine helped push production to a record high.[21] An important salt mine reportedly went into operation; the location is said to be

[20] Jen-min Jih-pao (People's Daily; Peiping). Apr. 9, 1969, p. 2.
[21] New China News Agency (International Service in English; Peiping). Oct. 6, 1969, p. 1.

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Li County, on the shore of Tungting Lake in Hunan Province.[22]

Although most salt was consumed for food purposes, industrial demand was rising. In fact, the Chinese Communists expanded chemical facilities using salt, such as the Tientsin soda plant. Traditionally, surplus salt has been exported, principally to Japan. About 1 million tons went to Japan in 1969, and contracts for future delivery to that country have been of the same magnitude.

Many salt byproducts were extracted in China, such as potassium chloride, bromine, boric acid, iodine, and barium chloride. Most of this byproduct output came from inland Tsinghai Province, where lake salt of complex nature was produced. Tsinghai reportedly topped its target for 1968; and production probably registered a further increase in 1969.

Steatite and Talc.—Chinese steatite and talc from Taling in Liaoning Province are world famous. Between one-third and one-half of the 1969 output was exported, with Japan the main purchaser taking 27,300 metric tons of steatite and 21,079 tons of talc during 1969. In 1967, the U.S.S.R. imported a combined 17,600 tons of steatite and talc from China, and Poland imported 549 tons of "talc" (1,823 tons in 1968).

MINERAL FUELS

Coal.—The coal industry had a very peaceful and stable year as compared with the dislocations and strife during 1967 and early in 1968, precipitated by the Cultural Revolution. By yearend 1968, however, the Chinese Communists claimed[23] that 68 of the country's 71 principal coal combines with more than a million workers had Great Revolutionary Alliances already in control. The situation further improved in 1969. Simultaneously, the overall transportation bottleneck began to ease although coal shortages persisted in some areas. Aided by two National Coal Conferences, which convened in 1968, operations gradually got back to normal in the coal mines. A further drive to raise production took place in 1969, using political slogans such as "grasp revolution, promote production, and prepare against war." The national emulation campaign, which was started at the Peking or Capital Steelworks, reached many coal mines by the latter part of the year, with reportedly good, but actually mixed, results. It appeared, nonetheless, that mainland China's total coal output finally had surpassed the 1966 record, signaling a higher production plateau for the 1970's. In 1969, the country's production of mine-run coal was on the order of 330 million metric tons.

Numerous coal combines reportedly fulfilled their 1969 output goals, as follows (when available, the number of days ahead of schedule is in parentheses): Fushun Fuhsin (15), Kailan (11), Tatung, Huainan, Chihsi, Hokang (12), Pingtingshan, Fengfeng, Tzupo, Peking (22), Yangchuan (22), Chiaotso (25), Shuangyashan (16), Tsaochuang, Huaipei, Penhsi (38), Chinghsing (49), Hopi, and others. It was also claimed that the combined average daily output rate of coal mines directly under the Ministry of Coal Industry (about 70-odd big and medium combines or administrations) during the fouth quarter of 1968 was a record high for recent years. By all indications, average overall performance was even better in 1969.

The Kailan Administration or combine in Hopeh Province, with a new hydraulic mine and corresponding 3-million ton preparation plant at Luchiatun, met a production quota apparently slightly higher than actual output in 1968. Kailan has long been known for its coking coal. Fushun in Liaoning Province had an excellent year, particularly the Hungwei open pit which fulfilled its 1969 target by mid-November. With both surface and underground coal mines such as Laohutai, the Fushun combine continued to expand as an industrial complex, adding a third oil refinery to existing oil shale, cement, aluminum, and nonferrous operations and recovering valuable raw materials from waste water, slag, and gases. The Fuhsin combine in Liaoning also reported success, with the Hsinchiu (Chinchu) open pit and the Pingan underground mine surpassing targets well ahead of schedule and the Haichow open pit running smoothly too.

Chihsi combine's Chengtzuho colliery was singled out as overfulfilling 1969 output and tunneling goals and the Tunghai colliery was also commended. The Hungwei, Hungchi, Yaochin, and Chunli collieries of the Hokang combine met their production plans well ahead of schedule. These two

[22] New China News Agency (International Service in English; Peiping). Dec. 3, 1969, p. 1.
[23] Ta-kung-pao (Peiping). Dec. 30, 1968, p. 1.

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combines were primarily responsible for pushing Heilungkiang Province's output over the top. The Tatung combine in Shansi Province, with many new collieries developed in the 1960's including Yungtingchuang and Luan, surpassed quotas for 19 consecutive months.[24] To the south in Anhwei, Huainan combine's big colliery, coincidentally also named Tatung, met its goal 2 months ahead of schedule.

These seven administrations or combines each produced 10 to 20 million tons of coal in 1969; combined output of the three leaders—Fushun, Fuhsin, and Kailan—probably exceeded 50 million metric tons. Another relatively new combine, Pingtingshan in Honan, continued to expand and may be pushing the 10-million-ton level; two collieries, No. 2 and Matsang, reportedly topped 1969 quotas by wide margins and eight other collieries also did well. Estimated 1969 output range for some of the combines in million metric tons of mine-run coal, are as follow:

Combine	Province	Output range, million metric tons
Fushun	Liaoning	17 to 20
Fuhsin	Liaoning	17 to 20
Kailan	Hopeh	16 to 18
Tatung	Shansi	12 to 14
Huainan	Anhwei	12 to 14
Hokang	Heilungkiang	12 to 14
Chihsi	Heilungkiang	12 to 14
Pingtingshan	Honan	7 to 9
Fengfeng	Hopeh	6 to 8
Peking	Peking	6 to 8
Tzupo	Shantung	5 to 7
Yangchuan	Shansi	5 to 7
Chiaotso	Honan	3 to 5
Shuangyashan	Heilungkiang	3 to 5
Huaipei	Anhwei	3 to 5
Penhsi	Liaoning	3 to 4
Tsaochuang	Shantung	2 to 4
Hopi	Honan	2 to 4
Chinghsing	Hopeh	2 to 3
Pinghsiang	Kiangsi	2 to 3
Peipiao	Liaoning	2 to 3
Hsian	Liaoning	2 to 3
Tungchuan	Shensi	2 to 3

Many lesser combines and mines, mostly producing 2 to 8 million tons of coal annually, were mentioned in the press. The Peking (Chinghsi) Mining Administration, China's big anthracite producer, claimed that four of its mines—Tatai, Chengtzu, Mentoukou, and Muchengchien—all attained 1969 targets more than a month ahead of schedule. The Yangchuan combine in Shansi established a daily output record while overfulfilling its 1969 tunneling quota. The Paoshan and Shuching (Linhsi) collieries of the Shuangyashan combine in Heilungkiang reported increased output with a new modern vertical shaft installed at Shuching. The old Penhsi (Penchi) combine in Liaoning, known for coking coal, streamlined management and pushed up production above plan. The Peipiao combine, also in Liaoning, improved coal transport. Progress was reported in some of Kirin's newer mines like Liaoyuan, Yensheng, and Shuangyang.

The Fengfeng combine was on a program of expansion. The new Hsingtai underground mine, also in Hopeh, started normal operations. The old Chinghsing colliery in Hopeh was rejuvenated, and its future appeared encouraging with discovery of new reserves. Another old combine—Chiaotso in Honan—was reportedly doing well. The Tzupo and Tsaochuang combines in Shantung were producing at levels higher than in 1967–68. Two strip mines totaling 900,000 tons annually were placed in operation by the Yaochieh combine in Kansu. The Akanchen colliery, also in Kansu, greatly increased production. A large vertical shaft mine was completed for the Huaipei combine in Anhwei early in the year.[25] In coal-poor Kiangsu Province, a new shaft mine of 450,000 tons yearly was built in the Hsuchou coalfield. The Pinghsiang combine farther south in Kiangsi established a daily output record. A large underground mine reportedly started operations in Hupeh Province.

Petroleum.—Crude oil production (including 2.5 to 3.0 million tons of oil from shale) in mainland China took another significant leap in 1969, reaching almost 20 million metric tons (for rough conversion of metric tons per year into barrels per day, divide by 50). There was no severe political or labor trouble in any of the operations and production was reportedly up in virtually all cases. Similar advances were made in refining, with capacity approximately sufficient for treating the crude produced. Generally, refineries were not located near oilfields but rather in the consuming areas. Taching overshadowed other oilfields; even the local refinery was large by Chinese standards although far from

[24] New China News Agency (International News Service in English; Peiping). Dec. 29, 1969, p. 1.
[25] Ta-kung-pao (Peiping). Mar. 8, 1969, p. 2.

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adequate to process the crude oil extracted. Taching may have reached its limit, so that substantial further increases in China's petroleum output may have to come from new fields like Shengli, Tsaidam, and offshore areas.

No significant oil-economizing drives have been reported since late 1967. Some coal-fired locomotives switched to fuel oil, and a Shanghai shipyard launched two 15,000-ton tankers to transport petroleum along the coast. All these facts strengthen the belief that production was at high levels and petroleum was not in short supply.

A few years ago, there was an estimate placing mainland China oil reserves at 15 billion barrels or 2-plus billion metric tons.[26] Outside of Taching, the areas included were Karamai, Yumen, Central Szechuan, and Tsaidam. This may denote an order of magnitude for reserves, as based upon rather incomplete and preliminary knowledge. The same source also noted that natural gas production may be about a billion cubic meters (35.3 billion cubic feet) per year and that the potential was thought to be much higher. The main natural gasfields were believed to be near Shanghai and in the Szechuan and Tsaidam basins.

The Chinese developed the nation's first "deep well drilling machine" late in 1968, weighing 300 metric tons and run by 3,000 horsepower diesel units. Although drilling depth was not known, this rig gives some indication of Chinese capabilities. The Chinese can build some of the less complicated type of refineries rather well now and have good knowledge of catalytic cracking. The four largest refineries—Taching, Lanchow, Fushun, and Shanghai—all have petrochemical plants, most of which also produce fertilizers.

Output at the Taching field has been steadily going up in the last 2 years, both in terms of crude and refined products. Crude production in 1968 had already attained the 1970 target of the "Third 5-Year Plan," which conservatively might be estimated at 8 to 9 million tons. Much drilling, development, and construction took place in 1969, indicating that a much higher level of production was in the offing. It was subsequently claimed that crude output had actually risen 37 percent over that in 1968 and that refined petroleum output was 11 percent higher.[27] Taching's local refinery Lungfeng between Anta and Saertu was originally capable of producing 2.0 to 2.5 million tons annually. Most likely, the refinery throughput capacity was greatly expanded late in 1969 in view of a claim that Taching's refinery and storage capabilities almost doubled. Nonetheless, most of the crude had to be shipped elsewhere for refining to places like Shanghai, Fushun, Dairen, Lanchow, and Maoming. A contract may have also been signed with North Korea to ship crude to a refinery being built at the south end of the border. All this tends to confirm that Taching's crude output had indeed attained significant levels.

The Karamai oil complex in Sinkiang, including the local oilfields and refineries at Karamai and Tushantzu, settled down to normal operations in the spring of 1968 after a Revolutionary Alliance was formed. The Alliance, representing some 30,000 workers and maintaining order with the help of the PLA, was able to keep production above planned levels. Crude output clearly surpassed last year's tonnage and may be conservatively estimated at 2.5 million metric tons. The Tushantzu refinery may have an annual capacity of 1 million tons, possibly not too different in size from the Karamai refinery; both apparently were being worked at capacity, with surplus crude shipped elsewhere for refining. One source[28] estimated Karamai crude reserves at about 1.9 billion barrels.

Output of the Yumen oilfield easily topped 2.5 million metric tons and may be as high as 3.0 million tons. The year's crude oil output target was achieved by September 24, 1969[29] and the planners added another 40 percent to the original quota. Shihyukou was the best known field, and Tungfeng as well has been often mentioned. Since "bloody clashes" ended late in 1967, output has been steadily rising to give new vitality to an old field. The local refinery has also been built up, but it is still one of the smaller ones so that perhaps two-thirds of Yumen's crude oil must be shipped elsewhere for refining, mainly to the Lanchow refinery.

[26] International Petroleum Encyclopedia. 1970, p. 200.
[27] New China News Agency (International Service in English; Peiping). Feb. 10, 1970, p. 1.
[28] World Oil. V. 169, No. 3, Aug. 15, 1969, p. 213.
[29] New China News Agency (International Service in English; Peiping). Dec. 8, 1969, p. 1.

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Lanchow had a very peaceful and productive year, under the guidance of the Revolutionary Committee and the PLA who gave the refinery a further push during the Ninth National Congress. The year's targets were fulfilled, which meant that most of the 3-million-ton annual capacity was utilized in processing crude coming from Yumen and Karamai fields, among others. Considerable technical progress was also reported. This industrial complex also has petrochemical, fertilizer, and machinery plants. It was reported that the machinery plant made large urea synthesizing vessels and some new drills and pumps.

Not too much was said about Shanghai, one of the country's large refineries with thermal cracking and platforming units. Crude came mainly by sea from Taching in Heilungkiang Province, Manchuria. This industrial complex was an important center for manufacturing oil refining and drilling equipment. During recent years, some important new techniques were introduced, including a modified process of catalytic cracking, new catalysts, and a special method of making petroleum coke. The 500,000-ton-per-year Dairen refinery was hardly mentioned; but three other refineries in Liaoning—No. 1, No. 6, and No. 7—reportedly did well in 1969. The No. 6 refinery at Chinchou, which is not large, seemed to have been working on local crude, synthetic fuels, and even edible oils.

The Shengli (Victory) field in Shantung, possibly located near the mouth of the Yellow River, was not mentioned in the press. Previously, there was speculation that it may be potentially very important and that some of the crude produced might be going to the Shanghai refinery. Another oilfield of possible future importance was reportedly discovered at Shashih in Hupeh, west of Tayeh.

Reportedly, offshore equipment was purchased by the Chinese from West Europe and Rumania. This strengthens the speculation that mainland China has started to look into the matter of offshore exploration and drilling for oil. Meanwhile, two separate investigating groups have surveyed in international waters contiguous to mainland China and found two promising areas—one in the Yellow Sea between mainland China and Korea and the other farther south in the Senkaku Islands, only 100 miles north of Taiwan. The first group, led by Dr. Emery of Woods Hole Oceanographic Institution and working from a U.S. Navy contracted research vessel, uncovered extensive and promising sediments in both areas. Subsequently, Dr. Niino of Tokai University, Japan, working on the Tokai Maru, confirmed the likelihood of finding oil in the Senkaku Islands. While all this work is preliminary and therefore hardly conclusive, at least some potential is indicated. So far the Chinese have not been active on the continental shelf beyond possibly the very near-shore areas at the mouth of the Yellow River.

Shale Oil.—The status of operations at Fushun became clearer during the year. The shale oil operations were back in full production, with the retorts feeding into two refineries. Crude output in 1969 probably was more than 1.5 million metric tons. A third refinery of at least one-million-ton annual capacity reportedly fulfilled its 1969 quota 17 days ahead of schedule; this appears to be the new unit refining crude oil shipped from the Taching field. Fushun waste shale has long been used for making cement. Other waste materials like water, slag, and gases were being utilized to make chemical, fertilizer, and other products. Oil shale mixed with local coal was also being used directly as fuel to generate power.

Maoming in Kwangtung Province has been mentioned so much in the Chinese press in 1968–69 that there seems to be no question that various facilities are in working shape and that considerable crude oil and refined petroleum products are being produced. Crude oil output in 1969 probably was in excess of 1 million metric tons, which was at least 50 percent more than the year before. Maoming's third retort plant was completed around September and a fourth was under construction.[30] Some byproduct metal of "great value" was also being recovered from the oil shale. Maoming may have only one large refinery, which refined not only the crude from local oil shale but also additional supplies from distant Taching. It is also possible that several smaller units were in existence to handle the various crudes. During the first half of 1969, the quantity of crude oil refined reportedly was 7.9 times as much as that in the first half of 1968. This implies

[30] New China News Agency (Peiping; in Chinese). Oct. 4, 1969, p. 1.

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either minimal operations in the earlier period when there was actually labor strife and/or the subsequent completion of large additional capacity. Nevertheless, Maoming was said to have overfulfilled 1969 production quotas 27 days ahead of schedule, with five major products surpassing all previous records.

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The Mineral Industry of Colombia

By Gordon W. Koelling

The outstanding 1969 development in the Colombian mineral industry was the initiation of crude oil production from the Putumayo area oilfields. Ouput from these fields not only halted a 3 year decline in Colombia's crude oil production but also increased the total annual output to an alltime high.

The performance of the other sectors of Colombia's mineral industry was mixed. Production of most metals declined although pig iron, steel ingots and castings, and platinum group metals registered gains. The output of most nonmetals was up, with barite and salt showing the largest gains. In the case of mineral fuels and related materials, the only important production increase was registered by crude oil; all other items showed some gains except natural gas liquids and refinery output, which declined slightly.

Colombia continued to be the world's principal source of emeralds, ranked among the top 10 gold producers, and was one of the few producers of platinum. The output of these commodities was less important to the country's economy than the production of such items as crude oil, coal, iron ore, limestone, cement, and salt.

Late in December 1969, the President of Colombia signed a major new law governing the country's mining and petroleum industries. This law specifies that (1) all mines belong to the nation; (2) mining rights held by private concerns will be cancelled if within 3 years the titleholders have not begun economic exploitation of the holdings, or if begun, exploitation is interrupted for more than 1 year; however, the title holders of cancelled mining rights are to have priority with respect to application for new concession contracts covering the same areas; (3) the Government may expropriate mining rights and properties if it deems such action necessary to obtain a quicker or greater amount of exploration or production; (4) the Government may delcare any territory that offers petroleum possibilities a national reserve and grant it, without subjection to the ordinary system of contracting or bidding, to the Government-owned oil company, Empresa Colombiana de Petróleos (ECOPETROL), for the latter to explore, exploit, and administer directly or in association with national or foreign, public, or private capital.

That part of the law dealing with petroleum was the latest step in the furtherance of Government policy favoring a larger role for ECOPETROL in future oil development contracts. Earlier in 1969, decrees were issued designating three areas for exploration by ECOPETROL, but this designation could not, under then existing petroleum legislation, convey exploitation rights. Consequently, these decrees were in effect a holding operation pending passage of legislation authorizing the establishment of national oil reserves. The Government's objective for acquiring such authority was to provide ECOPETROL with ample territory for development, especially on the basis of joint venture agreements with private companies.

PRODUCTION

Despite a sharp decline in the production of some items, especially gold, silver, iron ore, and marble, the overall trend of Colombia's 1969 minerals industry production was upward. Crude oil output registered the most significant increase although platinum, barite, salt, and natural gas production also showed sizable gains.

[1] Geographer, Bureau of Mines, Washington, D.C.

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Table 1.—Colombia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1967	1968	1969 [p]
METALS				
Gold, metal	troy ounces	257,668	r 239,555	218,872
Iron and steel:				
Iron ore and concentrate	thousand tons	807	r 578	352
Pig iron	do.	207	r 198	206
Steel ingots and castings	do.	252	r 256	263
Lead, mine output, metal content [e]		603	740	409
Mercury	76-pound flasks	210	r 362	344
Platinum-group metals	troy ounces	r e 19,000	r 22,280	27,805
Silver [2]	do.	110,442	100,344	77,136
Zinc, mine output, metal content [e]		506	r 650	423
NONMETALS				
Barite		6,007	r 7,000	12,242
Cement, hydraulic	thousand tons	2,114	2,367	2,408
Clays:				
Kaolin (including china clay)	do.	11	r 84	88
Other	do.	527	r 500	555
Diatomite		NA	13,179	15,976
Feldspar	thousand tons	18	r 21	22
Gem stones, emerald	thousand carats	256	1,020	NA
Gypsum	thousand tons	e 78	121	151
Lime	do.	876	915	NA
Mica, all grades		r e 23	r 26	17
Phosphate rock	thousand tons	------	------	12
Quartz, quartzite, and glass sand	do.	37	r 150	158
Salt:				
Rock	do.	310	317	344
Marine	do.	159	188	334
Total	do.	469	505	678
Stone, n.e.s.:				
Dolomite	do.	12	r 12	13
Limestone	do.	3,351	r 4,287	4,258
Marble	cubic meters	3,665	r 3,927	100
Sulfur, elemental		24,000	r e 32,250	e 30,700
Talc, soapstone, and pyrophyllite		e 1,000	1,349	1,525
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades	thousand tons	3,100	r 3,100	3,317
Coke, all types	do.	111	r 435	465
Fuel briquets, all grades	do.	14	16	NA
Gas, natural:				
Gross production	million cubic feet	99,920	r 95,357	103,882
Marketed	do.	37,721	r 38,247	44,767
Natural gas liquids	thousand 42-gallon barrels	2,914	r 3,302	3,210
Petroleum:				
Crude oil	do.	68,877	68,435	76,776
Refinery products: [3]				
Gasoline and naphthas:				
Aviation gasoline	do.	746	684	619
Motor gasoline	do.	13,277	13,842	14,338
Naphthas	do.	463	2,344	2,117
Kerosine and jet fuel:				
Kerosine	do.	2,540	2,958	3,147
Jet fuel	do.	526	835	1,085
Distillate fuel oils	do.	5,629	7,480	6,843
Residual fuel oil	do.	14,904	16,501	15,633
Liquefied petroleum gases	do.	862	1,183	1,216
Lubricants	do.	415	423	467
Asphalt and bitumen, refinery	do.	1,178	1,668	1,676
Petroleum coke	do.	703	896	825
Other	do.	1,643	1,415	1,847
Total	do.	42,886	50,229	49,813

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Carbon black, chromite, fertilizer materials, and magnesite are also produced, but the level of output is unknown.

[2] Reported by Banco de la Republica as precious metal refinery output.

[3] Includes refinery fuel.

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TRADE

Colombia continued to enjoy a favorable balance of mineral commodity trade in 1968 although shipments of crude oil, the country's principal mineral export items in terms of value, declined sharply. A majority of the mineral items imported registered increases.

Table 2.—Colombia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1967	1968
METALS		
Aluminum, metal, including alloys, all forms	259	126
Copper, metal, scrap	121	------
Iron and steel, metal, including alloys, all forms	2,451	664
Lead, ore and concentrate	429	1,130
Platinum, metal, troy ounces	14,214	25,913
Zinc, ore and concentrate	1,073	575
NONMETALS		
Cement	229,955	328,763
Clays and clay products (including all refractory brick):		
Crude: Kaolin and other clays	96	16
Products:		
Refractory	182	1,180
Nonrefractory	76	------
Fertilizer materials, ammonia	21,470	37,804
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades	1,422	2,713
Coke	75	89
Coal tar and mineral pitch	------	48,348
Petroleum:		
Crude, thousand 42-gallon barrels	31,148	18,448
Refinery products:		
Naphtha, do	------	1,242
Distillate fuel oils, do	------	2,038
Residual fuel oil, do	8,044	7,344
Other, do	179	56

[1] In addition to reported commodities, Colombia is known to export gold, silver, and emeralds, but data are not available concerning shipments of these items.

Major destinations of selected commodities, in 1968

(Thousand metric tons unless otherwise specified)

Commodity	Quantity
METALS	
Platinum, metal, total, thousand troy ounces	26
United States, do	26
NONMETALS	
Cement, total	329
Brazil	135
Puerto Rico	79
Fertilizer materials, ammonia, total	37
Costa Rica	13
Mexico	13
United States	6
MINERAL FUELS AND RELATED MATERIALS	
Petroleum:	
Crude, total, thousand 42-gallon barrels	18,448
United States, do	12,274
Refinery products:	
Naphtha, total, do	1,242
Netherlands Antilles, do	796
United Kingdom, do	289
Distillate fuel oils, total, do	2,038
Virgin Islands, do	988
United States, do	521
Residual fuel oil, total, do	7,344
United States, do	6,251

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Table 3.—Colombia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite and concentrate	5,988	5,930
Oxide (alumina) and hydroxide	431	750
Metal, including alloys:		
Ingots, castings, and scrap	4,748	9,018
Semimanufactures	995	1,158
Antimony, metal, including alloys	28	25
Copper, metal, including alloys, all forms	3,906	3,586
Iron and steel:		
Ore and concentrate	417	348
Metal:		
Pig iron and scrap	5,895	2,357
Ferroalloys	2,670	5,641
Steel, primary forms	7,535	46,505
Semimanufactures	77,672	122,564
Lead:		
Oxides	651	1,081
Metal, including alloys, all forms	1,559	2,270
Magnesium, metal, including alloys, unwrought	11	17
Mercury, 76-pound flasks	209	46
Nickel:		
Metal, including alloys, unwrought	41	39
Semimanufactures	89	27
Platinum-group metals, troy ounces	----	6,140
Silver, metal, including alloys, do	13,825	22,666
Tin, metal, including alloys, all forms, long tons	135	250
Zinc, metal, including alloys, all forms	2,453	4,381
NONMETALS		
Abrasives, natural, n.e.s.:		
Crude	59	396
Grinding and polishing wheels and stones	117	49
Asbestos, crude	13,752	12,761
Boron materials, refined borax	310	152
Cement	202	307
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s.:		
Bentonite	1,405	2,638
Kaolin (china clay)	2,255	3,194
Other	69	74
Products, refractory	2,562	3,286
Diatomite and other infusorial earths	920	1,203
Fertilizer materials, manufactured:		
Nitrogenous	10,115	7,690
Phosphatic	21,529	39,901
Potassic	48,438	60,983
Other, including mixed	21,118	33,985
Graphite, natural	46	46
Gypsum and plasters	9,537	12,374
Magnesite	70	118
Mica, all forms	137	20
Pigments, mineral	168	433
Sodium and potassium compounds, n.e.s.:		
Caustic soda	24,758	218
Sodium carbonate (soda ash)	950	26,910
Stone:		
Dimension stone	200	861
Dolomite, chiefly refractory grade	3,293	4,716
Sulfur	1,076	79
Talc, soapstone, and pyrophyllite	962	532
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	897	349
Petroleum, refinery products:		
Gasoline, thousand 42-gallon barrels	490	41
Kerosine and jet fuel, do	63	2
Distillate fuel oils, do	53	15
Lubricants, do	47	12
Mineral jelly and wax, do	164	181
Other	7	115
Mineral tar and other coal, petroleum, or gas derived crude chemicals	315	NA

NA Not available.

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COMMODITY REVIEW

METALS

Aluminum.—Investigation of the bauxite deposits in western Colombia continued during 1969. One result was an announcement by Government geologists that an estimated 700 million tons of low-grade aluminous laterite reserves are present in the area between Popayán in the Department of Cauca, and Cali in the Department of Valle. Kaiser Aluminum & Chemical Corp. holds the discovery rights to that portion of these deposits located in the Department of Cauca.

Applications have been filed for mining claims covering bauxite deposits discovered at Macarena in the Department of Meta. The Government's Instituto de Fomento Industrial (IFI) has an interest along with a private Colombian company. Ore contained in these reserves is high grade, but reserves have not yet been determined.

Gold.—Gold production continud to decline for the fifth consecutive year. The 9 percent drop in output during 1969 was due primarily to the lower grade of gravels worked in placer-mining operations, although the sinking of a dredge during the latter part of the year and a decline in underground operations were also factors.

Production of gold during 1969 by the four wholly owned subsidiaries of the International Mining Corp. (United States) totaled 96,132 troy ounces (44 percent of the country's output), of which 63,404 ounces were from Colombia's only underground gold mining operation at Frontino. Pato Consolidated Gold Dredging, Ltd., in which International owns the controlling interest, produced 72,312 troy ounces during the same year. In November 1969, one of the five dredges operated by Pato capsized while engaged in normal dredging operations. At yearend some equipment had been recovered, and work was in progress to determine the feasibility of salvaging the dredge.

Iron and Steel.—Completion of its ore-sinterization and oxygen-blasting facilities enabled Acerías Paz del Rio, S.A., the country's only producer of iron ore and pig iron, to begin drawing from its large stockpile of iron-ore fines during 1969. Consequently, the company was able to close down all but one of its iron ore mining operations and cut its ore production by 39 percent while increasing its pig iron output by 4 percent. All of this pig iron was used in the company's own steel mill, which accounted for 78 percent of the country's total steel ingot and castings output during the year. Supplier credits for the machinery needed for a planned 100,000-ton-per-year cold-rolled products mill were being sought by Acerías Paz del Rio at yearend, and a purchase contract was expected to be signed during 1970.

Several small producers completed or were in the process of constructing additional steel-producing facilities during 1969. Siderúrgica Muña and Empresa Siderúrgica del Pacífico installed 10,000- and 12,000-ton-per-year electric furnaces, respectively, and a 10,000-ton-per-year electric furnace was nearing completion at the Corporación de Acero steel mill. Empresa Siderúrgica de Medellín was in the process of doubling its electric-furnace capacity to 40,000 tons per year and was adding a line for bar and structural steel production. Completion of these projects was expected in 1970.

A pig iron furnace with a 30,000-ton-per-year capacity is reportedly to be installed at Tibitó, a town near Bogotá. Present plans call for the plant to be completed in mid–1971. The project is directed toward pig-iron supplies for foundry use. Ore for the plant will come from a deposit located at nearby La Calera. This is a shallow, surface deposit containing low-phosphorus ore with an iron content of 45–50 percent. Reserves are reported to total 600,000–800,000 tons of iron.

Nickel.—As of yearend 1969, negotiations were continuing between the Government, The Hanna Mining Co. and Chevron Oil Co., a subsidiary of Standard Oil Co. of California, concerning the development of a lateritic nickel deposit near Cerro Matoso in the Department of Córdoba. The two companies have proposed the establishment of an open pit mine and a smelter with an estimated capacity to produce 22,600 tons of ferronickel annually. It was also proposed that Hanna/Chevron have a two-thirds equity in the project; the remaining one-third participation would be reserved for Colombian interests.

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NONMETALS

Asbestos.—A Canadian firm began developing an asbestos deposit in the northern part of the Department of Antioquia late in 1969. Proved reserves in this deposit reportedly total about 10 million tons of ore with a 4-percent fiber content. The projected production rate is 2,000–2,500 tons of ore annually.

Fertilizer Materials.—In August 1969, the Compañía Colombiana de Minas (COLMINAS), a dependency of IFI, signed a contract with Pan American Consulting, Ltd., for the turnkey construction of a superphosphate plant at Ventaquemada in the Department of Boyacá. This plant, scheduled for completion during 1970, will have a production capacity of 70,000 tons per year. The project is the first step under an IFI program for processing Colombia's rock phosphate deposits, and the eventual production of phosphoric acid, triple superphosphate, and other products.

COLMINAS has announced plans to produce limestone for fertilizer from a deposit in the llanos of eastern Colombia. During the latter part of 1969, bids were invited on equipment for a concentrate plant, which is to have a capacity of at least 500 tons per day.

The completion of new facilities at the Amoniacos del Caribe (AMOCAR) petrochemicals plant at Mamonal during 1969 raised its ammonia output capacity to 375 tons per day, an increase of 65 tons daily. AMOCAR is owned by International Petroleum Colombia, Ltd. (INTERCOL), a subsidiary of Standard Oil Co. (New Jersey).

Fertilizantes Colombianos (FERTICOL) announced plans to invest $5 million[2] in the renovation of its fertilizer plant at Barrancabermeja. This plant's ammonia, ammonium nitrate, nitric acid, and urea units have regularly been subject to various operational difficulties.

Gem Stones.—The world's largest known emerald was discovered during the early part of 1969 at the privately owned Las Cruces mine located in the Department of Cundinamarca. This emerald reportedly weights 7,025 carats or slightly over 3 pounds. It will probably be retained in the country and displayed as a national treasure.

Salt.—IFI announced plans to expand its sea water evaporation facilities at Manaure. Annual output from these facilities is to be raised from 150,000 tons to 300,000 tons in 1970 and to 1,800,000 tons by 1972 when it is expected that substantial quantities will be exported. IFI also was in the process of expanding the daily ouput capacity of the Mamonal alkali plant to 750 tons of sodium carbonate, 260 tons of caustic soda, 250 tons of refined salt, and 108 tons of sodium.

MINERAL FUELS

Coal and Coke.—Production continued to be concentrated in the Departments of Cundinamarca and Boyacá, which together accounted for approximately 70 percent of the country's total output. The only major washery functioning in Colombia during the year was that operated by Acerías Paz del Rio, the principal producer and consumer of metallurgical coke. A program for test drilling coal deposits in the Department of Guajira was initiated by COLMINAS. If the results of this program are encouraging, IFI, COLMINAS's parent entity, plans to seek a joint venture arrangement with foreign capital for the development of these deposits. Coal produced from these deposits would probably be exported.

Carbonos de Carare, a company owned by Spanish/Colombian private interests, began production at an anthracite coal deposit in the Department of Santander during the latter part of 1969. The company hopes to export about 100,000 tons of anthracite annually, mostly to Spain.

Petroleum and Natural Gas.—Following 3 consecutive years of declining production, crude oil output rose 21 percent to a record high during 1969. All of this increase was accounted for by the Putumayo area fields which were placed in production during the early part of the year. All crude from these fields was exported. The aggregate output from the country's other fields continued to decline as in previous years.

Natural gas production also increased during 1969 but the rate of growth was only 9 percent. Most of the country's natu-

[2] Where necessary, values have been converted from Colombia Pesos (CP) to U.S. dollars at the rate of CPs 17.60 = US$1.00.

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ral gas output was from oilfields; that from the Putumayo area was considered of little commercial significance due to a high carbon dioxide content. Production of natural gas liquids decreased 3 perecnt during the year.

Table 4.—Colombia: Salient statistics of the petroleum and natural gas industry

		1967	1968	1969
Crude oil:				
Production	thousand 42-gallon barrels	68,877	63,435	76,776
Delivered to refineries	do.	39,043	45,244	46,565
Exported	do.	31,148	18,448	29,853
Natural gas:				
Production	million cubic feet	99,920	r 95,357	103,882
Consumption [1]	do.	37,721	r 38,247	44,767
Injected [2]	do.	42,097	r 41,325	37,421
Flared	do.	20,102	r 15,785	21,694
Natural gas liquids:				
Production	thousand 42-gallon barrels	2,914	r 3,302	8,210
Consumption [3]	do.	1,614	2,041	NA
Delivered to refineries	do.	897	886	1,133
Exported, mixed with crude oil	do.	224	215	NA
Refinery products:				
Refinery output [4]	do.	42,886	50,229	49,813
Consumption [5]	do.	28,530	30,728	32,005
Exported	do.	8,223	10,680	11,767

r Revised. NA Not available.
[1] Includes shrinkage at natural gas processing plants.
[2] Includes small quantities used for gas-lift operations.
[3] Excludes the propane and butane output of refineries.
[4] Includes refinery gains and quantities used for fuel.
[5] Excludes most oil company use.

Source: Centro de Información de la Industria Petrolera.

Proved reserves of crude oil increased 1 percent to a reported total of 1,036 million barrels at yearend 1969. As of the same date, proved reserves of natural gas totaled 1,939 billion cubic feet, 12 percent more than at yearend 1968. These increases were largely the result of new discoveries in the Putumayo area.

In June 1969, Texas Petroleum Co. (TEXPET) and Colombian Gulf Oil Co. signed an agreement with the Colombian Government regarding modification of the contracts covering their joint consessions in the Putumayo area. Five of these concessions were obtained under Decree Law 2140 of 1955, and the remaining three were obtained under the more stringent terms of Decree Law 10 of 1961. As a result of the June agreement, the five Law 2140 concessions were changed to conform to the terms of Law 10.

This concession contract modification will have a highly favorable effect on Government oil revenues from the Putumayo area petroleum operations. The applicable royalty for the TEXPET/Colombian Gulf Oil Co. concessions under Law 2140 was 3 percent; Law 10 specified a royalty payment of 7.5 percent during the initial 10 years of concession exploitation and 11.5 percent thereafter (the companies agreed to waive the 7.5 percent royalty period for the Putumayo area concessions). Depletion and amortization allowances are more generous under Law 2140 than under Law 10, and Law 2140 specifies a 50-year concession period with a possible extension of 20 years, while Law 10 concessions are for 40 years with a possible extension of 10 years. Law 10 also requires the relinquishment of 50 percent of a concession area after the first year of exploitation.

In June 1969, the Colombian Government issued a decree designating an area of 1 million hectares extending over contiguous portions of the Departments of Bolívar, Sucre, Córdoba, Magdalena, and Antióquia for exploration by the Government-owned oil company, ECOPETROL. Two additional areas were designated for exploration by ECOPETROL during the latter part of the year. One of these areas, consisting of 200,000 hectares in the Putumayo area, comprises the former Mandur concession, which was relinquished by TEXPET and Colombian Gulf Oil Co. in June 1969. The other area consists of 1.1 million hectares in the llanos of eastern Colombia. Under terms of the decrees designating areas for ECOPETROL, that company is authorized to carry out geologic and geophysical explora-

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tion and other studies to achieve a better knowledge of the areas' petroleum possibilities. The decrees do not confer exploitation rights, but other companies are restrained from submitting exploration concession applications covering any part of the designated areas, and ECOPETROL would have priority should it eventually desire to exploit all or parts of the designated areas.

Drilling activity increased during 1969 as a result of the improved petroleum investment climate in Colombia. Data on drilling activity and results were as follows:

	1968	1969
Wells drilled:		
Exploratory:		
Oil---number	5	9
Dry---do	12	22
Subtotal---do	17	31
Development:		
Oil---do	22	20
Injection---do	14	5
Dry---do	1	6
Subtotal---do	37	31
Total---do	54	62
Footage drilled---feet	400,088	430,180

Included among the successful exploratory wells drilled during 1969 was the discovery well of the La Cañada oilfield on a Tennessee Colombia, S.A. (TENNECOL) concession in the upper Magdalena valley. Two extension wells drilled in this field were also successful. Crude oil of very heavy gravity was discovered by Chevron Petroleum Co. of Colombia in two wells located 10 kilometers apart on the west edge of the llanos slightly south of Villavicencio. The company does not believe that these discoveries can be economically exploited unless lighter crude, which could be mixed with the heavy oil to form a mixture suitable for transport by pipeline without heating, is also found in the vicinity.

Capacity of water injection facilities at ECOPETROL's La Cira–Infantes field was increased from an existing 75,000 barrels of water per day to 175,000 barrels upon completion of the first stage of an expansion program during 1969. The second stage of this program, scheduled for completion in 1970 or 1971, is to raise water injection capacity to 265,000 barrels per day. It has been estimated that the two phases of this program together will increase recoverable reserves at La Cira–Infantes by 50 percent.

TEXPET, operator for the concessions it holds jointly with Colombian Gulf Oil Co. in the Putumayo area, placed a 1,000-barrel-per-day refinery on stream at the Orito oilfield in 1969. This small plant was built in Texas in skid-mounted sections by Howe-Baker Engineers, Inc. The sections were shipped by boat to Tumaco and then trucked to the refinery site where they were bolted together. By the end of the year, this plant was supplying all of TEXPET's Putumayo area refined products requirements.

Specifications for bids on a 3,500-barrel-per-day refinery at Neiva were issued during the latter part of the year. This plant is to be operated as a joint venture between TENNECOL and ECOPETROL, with the former holding a 51-percent controlling interest. Crude oil for the refinery will be obtained from TENNECOL's nearby Dina oilfield.

Ground was broken at midyear for an additional crude oil distillation unit at ECOPETROL's Barrancabermeja refinery. When this unit goes on stream, probably in late 1970, it will increase the Barrancabermeja plant's rated crude throughput capacity from 75,000 barrels per day to 100,000 barrels per day. This refinery experienced a series of problems during 1969 that necessitated the shutdown of several units for overhaul and repairs, and reduced throughput to 65,000 barrels per day for a number of months; these difficulties had reportedly been overcome by the end of the year.

In early 1969, the Colombian Government issued an executive decree directing ECOPETROL to establish a refinery in the western part of the country to serve that area's market. ECOPETROL was given the choice of establishing this refinery on its own or as a joint venture with other participants. The site of the plant remains to be determined by a technical commission which, during the latter part of the year, requested the Departments of Valle and Nariño to provide detailed reports supporting their claims for the location of the proposed refinery. Cali, Buga, and Buenaventura in the Department of Valle, and Tumaco in the Department of Nariño, have been mentioned as possible sites.

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The number of companies distributing refined products in Colombia was reduced to three as of August 1, 1969. On that date, the distribution network of Shell Colombia, S.A., which had been accounting for approximately 8 percent of the country's total product sales, was placed under the administration of Codi-Mobil, which had been handling about 18 percent of the total. The latter company, in which Mobil Oil Corp. holds an 88-percent equity, will manage, but not own, the transferred facilities. These facilities became the property of Mobil-Ami, a Colombian paint company, which is a wholly owned subsidiary of the Mobil Oil Corp. Other companies distributing refined products in Colombia are Esso Colombiana, S.A., and TEXPET.

The trans-Andean crude-oil pipeline from the Orito field in the Putumayo area to the port of Tumaco was placed in operation during March 1969. This 311-kilometer line, built for Colombian Gulf Oil Co. and TEXPET and operated by the latter, was laid with a combination of 18-, 14-, and 10-inch pipe and had an initial rated capacity of 100,000 barrels per day. Plans are to eventually increase the line's capacity to 150,000 barrels per day by adding a loop line for a portion of its length, constructing two new pumping stations, and by installing additional pumps at the four existing pumping stations.

A branch pipeline from Orito to a smaller field at Puerto Colon near the Ecuadorian border was also completed during the year, and an extension of this line across the border to the Lago Agrio oilfield was placed under contract. The extension of the line into Ecuador will serve as a temporary outlet for crude oil production from that country's Putumayo-Aguarico area pending completion of a line from that area directly to the coast.

At yearend 1969, construction was in progress on a refined products pipeline from the Barrancabermeja refinery in Colombia's Magdalena valley to Bucaramanga, 96 kilometers to the east. This 6-inch line, being built for ECOPETROL, will have a capacity of 8,000 barrels per day. Completion was scheduled for 1970.

Construction was completed or in progress during 1969 on several petrochemical facilities in addition to those summarized under "Fertilizer Materials." A 15,000-ton-per-year, low-density polyethylene plant, owned jointly by ECOPETROL and The Dow Chemical Co., was completed adjacent to the Barrancabermeja refinery. Construction was in progress on ECOPETROL's plant for the production of aromatic hydrocarbons. This plant, also located adjacent to the Barrancabermeja refinery, will have an annual capacity to produce 40,000 tons of benzene, 20,000 tons of which will be used in the manufacture of cyclohexane; over 40,000 tons of mixed xylenes; and possibly some toluene.

Construction continued on a 16,000-ton-per-year caprolactam plant at Barranquilla. This plant, scheduled to begin production during the latter part of 1970, was being built as a result of a petrochemical integration agreement between Colombian and Venezuela. ECOPETROL and the Venezuelan Government-owned Instituto Venezolano de Petroquímica (I.V.P.) will each have a 45-percent share in the venture, and a Netherlands company will have the remaining 10 percent. Cyclohexane from ECOPETROL's Barrancabermeja aromatic hydrocarbons complex and ammonia from an I.V.P. plant in Venezuela are to be the principal feedstocks for the Barranquila plant. Plans call for the installation of equipment necessary to convert a byproduct output of 4.3 tons of ammonium sulfate per ton of caprolactam produced into marketable fertilizer.

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Table 5.—Colombia: Distribution of landholdings, crude oil production, and refining capacity, by companies, 1969

Company [1]	Principal ownership or affiliation	Nationality of ownership	Concessions as of Jan. 1, 1969 (hectares)	Crude oil production (thousand 42-gallon barrels)	Refining capacity as of Dec. 31, 1969 (thousand 42-gallon barrels daily)
Antex Oil and Gas Co., Inc.	Petroquímica del Atlántico and U.S. citizens.	Columbian/United States.	([2])	3	------
Chevron Petroleum Co. of Colombia.	Standard Oil Co. of California.	United States	142,451	11,105	------
Colombia-Cities Service Petroleum Corp (COLCITCO).	Cities Service Co	----do	205,999	4,804	------
Colombian Petroleum Co. (COLPET).	Mobile Oil Corp. and Texaco Inc.	----do	286,457	7,499	4
Empress Colombiana de Petróles (ECOPETROL).	Colombian Government	Colombian	[3] 24,000	9,484	75
International Petroleum Colombia, Ltd. (INTERCOL).	Standard Oil Co. (New Jersey).	United States	112,450	------	55
Mecom, John W	John W. Mecom	----do	44,859	------	------
Phillips Petroleum Co	Phillips Petroleum Co	----do	236,074	------	------
Shell-Condor, S.A	Royal Dutch/Shell Group.	British/Dutch	147,510	7,813	------
Sinclair Colombian Oil Co	Sinclair Oil Corp	United States	48,149	------	------
Sinclair Colombian Oil Co. and BP Colombian, Inc.	Sinclair Oil Corp. and British Petroleum Co., Ltd.	United States/British.	67,691	7,917	------
Superior Oil International, Inc.	Superior Oil Co	United States	119,107	------	------
Tennessee Colombia, S.A. (TENNECOL).	Colombian citizens	Colombian	69,115	486	------
Texas Petroleum Co. (TEXPET).	Texaco Inc	United States	825,463	9,855	8
Texas Petroleum Co. and Colombian Gulf Oil Co.	Texaco Inc., and Gulf Oil Corp.	----do	1,240,400	17,810	1
Total			3,069,725	76,776	138

[1] Companies appearing in this column are limited to those listed as concessionaires in official records and publications. Such official lists exclude firms which have obtained a participating interest from concession holders of record.

[2] Owns controlling interest in and is the operator for the El Difícil concession included in the area listed under Shell-Condor, S.A.

[3] Excludes areas designated for exploration by ECOPETROL. The decrees designating these areas authorize ECOPETROL to carry out geologic and geophysical exploration and other studies but do not confer exploitation rights.

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The Mineral Industry of the Democratic Republic of the Congo (Kinshasa)

By Eugene R. Slatick [1]

In 1969 the economy and investment climate of the Congo (Kinshasa) continued to improve. The mineral industry, particularly copper mining and processing, remained the mainstay of the country's economy.

In September the Congolese Government and the Belgian Société Générale des Minerais (SGM) entered into an agreement providing for compensation for the mining properties of Union Minière du Haut-Katanga (UMHK) that were nationalized in January 1967. The agreement consists mainly of a 25 year extension of the technical cooperation agreement signed in February 1967 by SGM and La Générale Congolaise des Minerais (GECOMIN), the Government-owned company. The 1967 agreement was to run for at least 3 years, after which notice of termination could be given by either party.

Under the 1969 agreement, SGM will receive an amount equal to 6 percent of the value of GECOMIN's annual production for 15 years, after which the amount will be reduced to 1 percent and cover only technical cooperation and related expenses. The 6-percent share includes compensation for the properties. Hence, the amount realized by SGM will depend on the general prosperity of GECOMIN. The payment under the 1967 agreement was 4.5 percent, which included large temporary expenses in addition to technical cooperation fees.

In June the Government enacted a new investment code that is designed to attract foreign investors, to create new businesses and to expand and modernize existing firms.[2] The new legislation provides various tax exemptions, foreign exchange guarantees, and other incentives.

Late in the year Falconbridge Nickel Mines, Ltd., of Canada was preparing to establish a subsidiary, Falconbridge of Africa (Congo), Ltd., in Kinshasa. The new company reportedly will seek exploration and development rights for copper in Katanga.

PRODUCTION AND TRADE

The available data for mineral production and trade are listed in the following tables:

[1] Foreign mineral specialist (petroleum), Bureau of Mines, Washington, D.C.

[2] International Commerce. V. 75, No. 31, Aug. 4, 1969, p. 25.

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Table 1.—Congo (Kinshasa): Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Beryllium, beryl concentrate, gross weight	2	-----	144
Cadmium, metal	263	320	597
Cobalt, metal	9,718	r 10,549	10,466
Columbium, tantalum, concentrate	146	113	83
Copper, metal, blister and refined	318,976	r 324,500	362,216
Germanium, mine output, metal in concentrate ---kilograms	347	-----	11,000
Gold, metal ---troy ounces	153,520	169,975	175,804
Lead, metal, including secondary	• 1,000	-----	-----
Manganese, ore and concentrate, gross weight	271,636	321,811	311,429
Rare earths, monazite concentrate, gross weight	NA	-----	178
Silver, metal, secondary ---troy ounces	1,839,763	2,139,082	• 1,896,000
Tin:			
Mine output, metal content ---long tons	4,664	6,895	6,718
Metal, primary ---do	1,815	1,892	1,882
Tungsten, mine output, metal content	112	82	136
Zinc:			
Mine output, metal content	121,547	126,529	• 127,500
Metal, primary	61,492	62,578	63,732
NONMETALS			
Cement, hydraulic ---thousand tons	• 260	NA	NA
Diamond:			
Gem ---thousand carats	263	551	491
Industrial ---do	12,891	11,353	13,625
Total ---do	13,154	11,904	14,116
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous ---thousand tons	133	71	66
Petroleum:			
Refinery products:			
Motor gasoline ---thousand 42-gallon barrels	-----	691	• 700
Kerosine and jet fuel ---do	-----	424	• 440
Distillate fuel oil ---do	-----	1,006	• 1,050
Residual fuel oil ---do	-----	1,595	• 1,700
Liquefied petroleum gas ---do	-----	10	• 10
Total ---do	-----	3,726	• 3,900

• Estimate. r Revised. NA Not available.

Table 2.—Congo (Kinshasa): Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968 [1]
METALS		
Cadmium, metal, including alloys, all forms	270	200
Cobalt, metal, including alloys, all forms	7,880	10,000
Columbium-tantalum, concentrate	61	130
Copper, metal, including alloys: Unwrought:		
Blister and other unrefined, unalloyed	• 76,000	NA
Refined, unalloyed, mainly wire bars	152,755	NA
Cathode	65,216	NA
Total	• 293,971	300,000
Gold, metal, unworked or partly worked ---troy ounces	NA	95,000
Iron and steel, metal, ferroalloys	1,968	NA
Manganese, ore and concentrate	275,921	300,000
Tin:		
Ore and concentrate ---long tons	6,229	5,000
Metal, including alloys, all forms ---do	1,299	1,800
Tungsten, ore and concentrate	97	70
Zinc:		
Ore and concentrate	57,196	40,000
Metal, including alloys, all forms	78,544	60,000
NONMETALS		
Cement	33,229	50,000
Diamond, all grades ---thousand carats	• 13,100	11,000

• Estimate. NA Not available.
[1] Estimate based on data for 9 months.

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Table 3.—Congo (Kinshasa): Imports of major mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, all forms	788	NA
Iron and steel, semimanufactures	50,759	NA
Other: Ores, scrap, waste, n.e.s.	320	NA
NONMETALS		
Cement	544	NA
Fertilizer materials	5,974	NA
Salt	27,941	NA
Other:		
Building materials of asphalt, asbestos and fiber, cement and unfired nonmetals, n.e.s.	1,517	NA
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	227,724	• 230,000
Petroleum refinery products:		
Gasoline, aviation thousand 42-gallon barrels	283	• 101
Gasoline, motor do	979	
Kerosine and jet fuel do	492	• 36
Distillate fuel oil do	1,186	• 491
Residual fuel oil do	317	• 58
Lubricants do	61	• 42
Liquefied petroleum gas do	• 10	• 5
Other do	• 50	
Total do	• 3,378	• 733
Mineral tar and other coal, petroleum, or gas-derived crude chemicals	5,125	NA

• Estimate. NA Not available.

COMMODITY REVIEW

METALS

Columbium-Tantalum.—Société Minière Union Carbide-Somikubi—SOMUCAR, a joint venture comprised of the Congolese Government and Union Carbide, expects to start production at the pyrochlore deposits at Bingo in 1970. A plant under construction at Bingo will produce preconcentrates containing 40 to 45 percent Cb_2O_5. Proven ore reserves total 2.3 million tons containing 3.6 percent Cb_2O_5 to depths of 25 meters; probable reserves are estimated at 4.8 million tons containing 2.4 percent Cb_2O_5.

Copper.—Copper production in 1969 rose by about 12 percent, the largest increase in recent years. This, together with the high prices for copper on the world market, added to the country's foreign exchange earnings. Copper exports in 1968 were valued at $353 million,[3] compared with $201 million in 1967. The two principal destinations in 1968 were Belgium-Luxembourg (220,000 tons) and Italy (37,000 tons).

Copper production in 1968 and 1969 was as follows, in metric tons:

Form	1968 (revised)	1969
Blister	87,101	127,142
Electrolytic	237,399	235,074
Total	324,500	362,216

GECOMIN reports that production probably will not rise significantly in 1970 but should reach about 450,000 tons in 1973 and about 560,000 tons in 1978.[4]

The additional tonnage is to come mainly from the Kamoto and Kipushi mining areas. An underground mine at Kamoto is expected to begin production in 1970 or 1971 at an initial rate of 500,000 tons per year of ore, averaging about 4 percent copper. The output is expected to increase to about 3 million tons by 1976. A new shaft is to be constructed at Kipushi, where the annual ore output is expected to rise from about 1.1 million tons to about 1.4 million tons in several years. Although the ore reserves at the operating mines are adequate for the planned increase in production, other ore bodies in GECOMIN's concession have not yet been developed. These include one ore body near Fungurume that reportedly is the largest undeveloped deposit; two other large deposits are at Mashamba and Dikuluwe.

Plant expansions scheduled include adding a new section to the Kipushi concen-

[3] Where necessary, values have been converted from Zaires to U.S. dollars at the rate of Z1 = US$2.00

[4] La Générale Congolaise des Minerais. Rapport Annuel. 1968, p. 7; June 30, 1969, p. 37. World Mining. V. 6, No. 2, February 1970, pp. 7–8.

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trator, doubling the capacity of the Kamoto concentrator, expanding the Luilu cathode works to 159,000 tons per year, and modernizing the Kambove concentrator, the Ruwe beneficiation plant, and the Lumbumbashi smelter.

During the year Société de Developpement Industriel et Minier du Congo (SODEMICO), a joint venture of the Congolese Government and a Japanese consortium, completed prospecting in the Musoshi area and surveying in the Kisenda area. New ore deposits, averaging 3 percent copper, were found in the first hole drilled in the Kimpa district, where the copper mineralization was reported as being 4 meters thick and 290 meters deep. SODEMICO's proven reserves consist of 110 million tons, averaging 2.1 percent copper at Musoshi, and 30 million tons, averaging 4.5 percent copper at Kisenda.

The company began development work at Musoshi in June. Production of concentrates containing about 36 percent copper [5] is scheduled to begin about September 1972 at the rate of 53,000 tons of contained copper per year, all for shipment to Japan. Production is expected to reach 100,00 tons by 1978.

In May a law (Ordonnance Loi No. 69/018) was enacted that places an additional tax on copper shipments whenever the market price is above 50,000 Belgium francs (BF) per ton (equivalent to about 45.4¢ per pound), presumably at the Brussels (Bruxelles) exchange. The tax rates vary with the different types of copper. The law apparently was enacted because of the high prices for copper on the world markets.

Germanium.—Production of germanium was resumed during the year. The output reportedly came mainly from the treatment of stocks of renierite at Likasi. The germanium ore occurs at GECOMIN's Prince Leopold mine at Kipushi, where the principal minerals mined are copper and zinc.

NONMETALS

Diamond.—In April, Société Minière de Bakwanga (MIBA) granted the Congolese Government a 50-percent interest in its diamond operations. If MIBA ceases operations, the mines and the equipment become the property of the Government.

After 2 years of negotiations, MIBA's concession was revalidated by the Government. It had been granted originally by the Belgium Government and was annulled under the Bakajika Law of 1967. MIBA's operations continued to be plagued by poaching.

A diamond purchasing office was opened in Kinshasa for a 3-month period beginning in January. During that time the laws against the possession, transport, and sale of diamond were not enforced within the limits of western and eastern Kasai. The period apparently was extended for an additional 3 months. Presumably, the diamond purchasing office, which opened in Tshikapa in October 1968, also remained open from January through June 1969.

Continuing its efforts to reduce smuggling by legalizing artisanal mining, the Government opened two additional diamond mining sites to local miners early in the year. Franchises were granted for 2 years, with the possibility of renewing them for up to 10 years. The areas are in the Sankuru and Kabinda districts of western Kasai and are adjacent to areas already being exploited near Tshikapa. Late in the year the Government decided to stop issuing permits for artisanal operations.

The Congolese Press Agency reported that mine police seized 7.8 million carats of illegally held diamond during the year.

MINERAL FUELS

Petroleum.—Late in the year the Government renewed the concession permits held by Société Congolaise de Recherches et d'Exploitation Petrolières (SOCOREP) and Gulf Oil Corp./Syndicat Minier Africain (SYMAF). The permits were suspended when the Congo became independent in 1966. Under legislation enacted in 1967, the concessions had to be revalidated. SOCOREP's concession covers about 4,400 square kilometers on land; Gulf-SYMAF's about 1,500 square kilometers offshore.

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[5] World Mining. V. 5, No. 11, October 1969, p. 47.

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SOCOREP plans to start work on its concession in early 1970. The Congo's oil potential has been enhanced by the discovery of large oil reserves in neighboring Cabinda. At yearend, Amoco Minerals, a subsidiary of Standard Oil Co. (Indiana), reportedly sought exploration rights in the country.[6]

[6] Petroleum Press Service. V. 37, No. 1, January 1970, p. 33.

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The Mineral Industry of Cyprus

By Eugene R. Slatick [1]

The most significant events in the mineral industry of Cyprus in 1969 were the beginning of operations of a copper-leaching plant and the depletion of a copper mine. At the beginning of the year, mining leases and licenses covered about 396 square kilometers (compared with about 411 square kilometers at the beginning of 1968), including about 46 square kilometers for quarry operations (64 square kilometers at the beginning of 1968).[2] Prospecting permits covered 343 square kilometers (about 293 square kilometers at the beginning of 1968). Exploratory drilling in 1968, the most recent year for which data were available, totaled 68,341 meters, down from 87,406 meters in 1967; most of the drilling was by Cyprus Mines Corp. In 1969 an estimated 5,200 persons were employed in mining and quarrying operations. The largest employers were Cyprus Mines Corp. (about 2,100 employees) and Hellenic Mining Co. Ltd. (about 1,100 employees). During the year, reports were published about the history, geology, and mineralization (noncuprous disseminated pyrite) of the Memi mine of Hellenic Mining Co. Ltd. and about the mineralization near Troulli, about 26 kilometers southeast of Nicosia.[3]

[1] Foreign mineral specialist (petroleum), Bureau of Mines, Washington, D.C.

[2] Petropoulos, P. G. Annual Report of the Senior Mines Officer for the Year 1968. Nicosia, 1969, p. 5. (44 pp.) This report provided information for other parts of this chapter.

[3] Lilljequist, R. The Geology and Mineralization of the Troulli Inlier. Ch. in Bull. 4. Republic of Cyprus, Ministry of Commerce and Industry, Geol. Survey Dept. Bull. 4, October 1969, pp. 45–87.

Pantazis, Th. M. The Memi Mine. Ch. in work cited above pp. 37–44.

PRODUCTION AND TRADE

The available data for mineral production and trade are listed in the following tables:

Table 1.—Cyprus: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Chromite	21,806	25,104	23,543
Copper [1]	15,507	17,036	19,929
NONMETALS			
Asbestos	r 19,760	r 19,817	19,400
Bentonite	4,531	10,160	10,000
Cement	186,708	241,844	242,601
Gypsum:			
Crude	45,700	20,820	16,287
Calcined	16,300	30,480	10,318
Lime	e 82,000	e 85,000	99,898
Mineral pigments:			
Terre verte	17	7	------
Umber	11,826	6,118	16,883
Yellow ocher	463	650	------
Pyrites (sulfur content) thousand tons	418	420	401
Salt	6,687	4,816	5,778

e Estimate. r Revised.

[1] Estimated content of concentrates, cement copper, and cuprous pyrite; excludes content in iron pyrite.

Table 2.—Cyprus: Exports of mineral commodities

(Metric tons)

Commodity	1967	1968
METALS		
Chromite	27,881	23,970
Copper:		
Concentrate	45,841	63,758
Cement	8,914	12,262
Cuprous pyrite	186,621	150,397
NONMETALS		
Asbestos, crude	18,839	17,984
Bentonite	4,612	9,215
Gypsum:		
Crude	13,162	10,295
Calcined	298	216
Mineral pigments:		
Ocher	463	650
Terre verte	16	7
Umber:		
Crude	853	6,119
Burnt	5,388	
Pyrite	721,660	811,814
Others	5,189	1,422

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Table 3.—Cyprus: Imports of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum and alloys	424	794
Copper, including brass	51	132
Gold, troy ounces	16,084	15,788
Iron and steel:		
Pig iron and ferroalloys	366	1,666
Semimanufactures	59,151	64,430
Lead and alloys	97	176
Tin and alloys, long tons	613	721
Zinc and alloys	211	477
NONMETALS		
Asbestos	165	------
Cement	17,887	10,121
Clays	316	1,429
Fertilizer materials, manufactured:		
Nitrogenous	27,680	17,719
Phosphatic	20,233	27,587
Potassic	297	592
Salt	216	375
Sulfur	------	2,435
Stone, monumental	------	484
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	15,460	17,834
Coal	177	198
Coke	209	922
Petroleum refinery products:		
Motor gasoline, thousand 42-gallon barrels	660	690
Distillate fuel oil, do.	743	997
Residual fuel oil, do.	1,317	1,566
Other, do.	329	539

COMMODITY REVIEW

METALS

Chromite.—Hellenic Mining Co. Ltd. remained the country's only chromite producer. At the beginning of 1969 the company had chromite stocks totaling 7,979 tons. Exports in 1968 were chiefly to three countries: Austria, 9,105 tons; France, 8,651 tons; and Canada, 6,198 tons.

Copper.—During the year Cyprus Mines Corp. put into operation a $3 million, high-temperature pressure-leach plant that can process mill tailings containing less than 1 percent copper. The plant's output will consist of copper in an acid-water solution, which will be piped to the existing precipitation plant for the production of precipitate copper. The output of the pressure-leach plant is expected to offset the company's decreased production due to the lower grade of ore being mined. Mine tailings are expected to provide sufficient feed for the plant until at least 1976.

The company's planned output of ore in 1969 was 60,000 to 70,000 tons from the Mavrovouni mine, which ended operations during the year; about 300,000 tons from the Skouriotissa mine, which is expected to remain active through 1971; and about 300,000 tons from the Apliki mine, a new open-pit mine still considered in the development stage in early 1969. The Lefka "A" mine was still under development; production is scheduled to begin in 1970. Proven reserves at Apliki and Lefka "A" are expected to be depleted about 1973. Studies were made during the year to determine if a new zone of low-grade copper mineralization near the Skouriotissa mine could be developed economically. The zone contains reserves estimated at 20 million tons averaging 0.58 percent copper.

Most of the output of the Hellenic Mining Co. Ltd. continued to come from the Mousoulos ore body at the Kalavasos mine. Development work in 1968 totaled 578 feet of shafts and 8,866 feet of drives.

In 1968 Cyprus Sulphur and Copper Co. Ltd. milled 465,681 tons of ore averaging 1.09 percent copper from the Limni mine. Output was 20,970 tons of copper concentrate averaging 20.45 percent copper.

NONMETALS

Asbestos.—Cyprus Asbestos Mines, Ltd., quarried 3.4 million tons of rock in 1968, compared with 3.5 million tons in 1967. About 1.4 million tons were milled to produce 11,162 tons of long-grade fibers and 8,155 tons of short-grade fibers. In 1968, the Asbestos Cement Factory at Moni manufactured 75 tons of flat sheets, 972 tons of corrugated sheets, and 229 tons of molded goods.

Cement.—The steadily rising output of the plants of Cyprus Cement Co., Ltd., and Vassiliko Cement Works, Ltd. (a subsidiary of Hellenic Mining Co. Ltd.) continued to make Cyprus more self-sufficient in cement. Cement imports in 1968 were about 43 percent lower than in 1967.

Fertilizer Materials.—No progress was reported regarding plans to build an 80,000-ton-per-year fertilizer plant near Larnaca.

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The plant is to utilize the country's pyrite deposits and supply the domestic market as well as an export market.

MINERAL FUELS

A contract was awarded to a British company to build a 15,200-barrel-per-day refinery at Larnaca.[4] The refinery is expected to be operating in late 1971. It will have the right to supply all the country's requirements for the refined products produced. The refinery will be operated by Cyprus Petroleum Refining Co., Ltd., a consortium comprised of the Government, the Cypriot marketing subsidiaries of Shell and Mobil oil companies, and Petrolina, a Greek-Cypriot marketing company. The marketing subsidiaries of two other oil companies, Standard Oil Co. (N.J.) and Fina, will have processing rights at the refinery.

[4] World Petroleum. V. 40, No. 13, December 1969, pp. 12A–12B.

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The Mineral Industry of Czechoslovakia

By Bernadette Michalski [1]

The imbalances in the Czechoslovak economy, aggravated by the political and economic upheavals of 1968, continued. Fluctuations in labor growth and labor productivity, as well as shortages in consumer goods, fuel, and power, contributed to the increasing inflationary pressures. The industrial growth rate increased 5 percent in 1969, falling short of the goal of 7 percent. Productivity increased 4.5 percent, compared with a planned 5.8-percent increase. The average nominal wage increased 6.5 percent, compared with the planned 4.3-percent increase. By May 1969 the Government issued price and wage control measures and attempted to offset repeated fuel and power shortages by organizing a centralized distribution agency for fuel and energy supplies.

Economic programs for 1970 were announced which basically reasserted centralized economic controls, often at the expense of economic reform measures. The plan focused on increasing productivity during 1970 with more emphasis on efficient utilization of labor and capital rather than on new investments.

PRODUCTION

Official published data on Czechoslovakia's 1969 mineral output available at the time of this writing were limited to a few major commodities such as bituminous coal, lignite, iron ore, iron and steel, and cement. Nevertheless, available information on the industry's general performance indicates that production of most commodities probably reached new highs in 1969.

In 1969, for the first time in recent years, official Czechoslovak sources published statistics on output of selected nonferrous metals through 1968. Such data on antimony, copper, lead, and mercury have been substituted in table 1 for U.S. Bureau of Mines estimates published in previous editions of this chapter. Moreover, data on zinc have been included for the first time in recent years, and estimates of silver production have been revised downward, based on the byproduct relationship of this metal to the major nonferrous metals for which published data became available.

[1] Foreign mineral specialist, Bureau of Mines, Washington, D.C.

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Table 1.—Czechoslovakia: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1967	1968	1969 p
METALS				
Aluminum, metal, including secondary e	thousand tons	65	65	65
Antimony:				
Mine output, metal content e r		500	600	600
Metal		1,100	1,200	e 1,350
Copper:				
Mine output, metal content		3,900	4,500	e 4,800
Metal, including secondary		11,077	11,754	e 12,200
Iron and steel:				
Iron ore	thousand tons	1,914	1,573	1,572
Pig iron (including blast furnace ferroalloys)	do	6,822	6,920	7,045
Ferroalloys, electric furnace	do	97	100	105
Steel ingots and castings	do	10,002	10,555	10,819
Steel semimanufactures	do	8,103	8,558	9,000
Lead:				
Mine output, metal content		6,800	7,100	e 7,300
Metal, including secondary		17,526	17,873	e 18,000
Manganese ore, gross weight		80,000	86,000	e 90,000
Mercury, metal	76-pound flasks	203	116	e 150
Nickel, metal, primary e		800	800	800
Silver e	thousand troy ounces	r 1,100	1,100	1,100
Tin, mine output, metal content	long tons	150	162	140
Zinc, mine output, metal content		7,559	9,875	e 10,000
NONMETALS				
Barite e		6,500	6,500	7,000
Cement, hydraulic	thousand tons	6,460	6,493	6,732
Clays, kaolin (including china clay)	do	335	341	e 350
Fertilizer materials: Manufactured:				
Nitrogenous, N content	do	245	262	e 275
Phosphatic:				
Thomas slag, P_2O_5 content		16,512	10,302	e 10,300
Other, P_2O_5 content		257,685	253,516	e 260,000
Gypsum and anhydrite:				
Crude	thousand tons	371	407	e 425
Calcined	do	22	24	e 25
Lime (quicklime and hydrated lime)	do	2,362	2,310	e 2,300
Magnesite:				
Crude	do	2,106	2,150	e 2,200
Clinker	do	517	e 800	e 900
Perlite e		8,000	10,000	10,000
Pyrite:				
Gross weight	do	376	380	e 400
Sulfur content e	do	160	161	166
Salt	do	202	205	e 207
Stone, sand and gravel, n.e.s.:				
Dimension stone: Limestone and other calcareous	do	r 16,525	16,841	e 17,000
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen		611,033	674,720	e 700,000
Coal:				
Bituminous	thousand tons	25,946	25,927	27,210
Lignite and brown	do	71,362	74,885	79,332
Coke:				
Bituminous coal	do	9,307	9,538	e 9,800
Brown coal	do	1,812	1,808	e 1,850
Fuel briquets, brown coal	do	912	1,100	e 1,200
Gas, manufactured, all types	million cubic feet	214,677	226,754	e 230,000
Petroleum:				
Crude oil	thousand tons	200	205	210
Refinery products:				
Kerosine	do	216	210	NA
Diesel oil	do	2,460	2,622	NA
Lubricants	do	124	116	NA

e Estimate. p Preliminary. r Revised. NA Not available.

[1] In addition to commodities listed, Czechoslovakia is known to produce gold and fluorspar, but production data are not available.

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TRADE

No details on Czechoslovakia's overall 1969 mineral commodity trade were available at the time of this writing, but presumably trade in these commodities shared in the overall increase in the 1969 volume of trade. Press reports indicate that during 1969, Czechoslovak trade with other Communist countries (chiefly the U.S.S.R.) increased 5 percent, while trade with non-Communist nations advanced 11 percent. Quantitatively, however, the increase in trade with Communist countries was greater than with the non-Communist nations, because over two-thirds of total trade was with Communist nations. Czechoslovak sources indicated that plans for 1970 include expanding trade with other European Communist nations by about 7 percent, compared with a 3-percent increase in trade with non-Communist nations. This shift, coupled with a reversal of the efforts on the mid-60's to encourage individual enterprises to engage directly in foreign trade rather than dealing through the foreign trade ministry, points to a reversal in the trend of increasing liberalization of trade policy.

The mineral commodity trade tables for 1967 and 1968 which follow are the most recent, reasonably complete data available, and were compiled, chiefly from trade returns of other nations, listing each country's imports from Czechoslovakia as exports of Czechoslovakia, and each country's exports to Czechoslovakia as imports of Czechoslovakia. This policy has been adopted because of the incomplete nature of official Czech trade returns. It is believed, however, that this method results in a reasonable approximation of Czechoslovakia's total mineral trade.

On the basis of this reverse trade data, Czechoslovakia's mineral commodity exports to non-Communist nations (including Yugoslavia) were valued in excess of US$158 million [2] in 1968, about 5 percent above the 1967 level, while the country's 1968 mineral commodity imports from these countries were valued at about US$46 million compared with approximately US$82 million for 1967.

[2] Where necessary, values have been converted from the Czechoslovakia Koruna (Kcs) to U.S. dollars at the rate of Kcs 7.20=US$1.00.

Table 2.—Czechoslovakia: Exports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum, metal including alloys, ingots, and semimanufactures	6,771	8,826	Austria 2,545; West Germany 1,985.
Copper:			
Ore and concentrate	5,327	3,062	Japan 2,077.
Metal, including alloys, ingots, and semimanufactures	950	3,025	All to West Germany.
Iron and steel:			
Ore and concentrate:			
Iron ore	9,082	5,535	All to Austria.
Roasted pyrite	------	615	Do.
Scrap—thousand tons	8	16	West Germany 13.
Pig iron—do	196	66	Japan 63.
Ferroalloys—do	28	28	West Germany 7; United Kingdom 6.
Steel:			
Ingots, and other primary forms—thousand tons	49	114	West Germany 47; Italy 36.
Semimanufactures [2]—do	1,990	2,124	U.S.S.R. 189; West Germany 183; Poland 176.
Lead:			
Ore and concentrate	354	1,292	All to West Germany.
Metal, including alloys, ingots, and semimanufactures	167	2,996	Do.
Magnesium, metal, all forms	228	177	Do.
Nickel:			
Matte and speiss	20	------	
Metal, including alloys, ingots, and semimanufactures	468	265	West Germany 257.
Tin:			
Ore and concentrate—long tons	------	51	All to United Kingdom.
Metal, including alloys, ingots, and semimanufactures—long tons	------	15	All to Turkey.
Titanium dioxide	285	328	France 180.
Tungsten:			
Ore and concentrate	114	418	West Germany 289.
Metal, all forms	------	20	All to West Germany.

See footnotes at end of table.

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Table 2.—Czechoslovakia: Exports of selected mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS—Continued			
Zinc, ore and concentrate	13,326	19,360	Yugoslavia 17,602.
Metals, nonferrous, n.e.s.:			
Ore and concentrate	5,018	------	
Scrap, ash, etc	26,402	10,647	West Germany 4,177; Austria 3,780.
Metal, all forms	998	1,679	West Germany 1,112.
NONMETALS			
Asbestos, crude	589	------	
Barite	[3] 5,208	360	All to West Germany.
Cement, thousand tons	195	151	Yugoslavia 129.
Clays and related products:			
Crude clays [4] do	291	324	West Germany 146; Italy 49; Yugoslavia 39.
Bricks:			
Nonrefractory	21,077	21,150	West Germany 6,535; Austria 4,167; Yugoslavia 2,489.
Refractory	19,290	19,099	West Germany 6,376; Sweden 5,979.
Feldspar, fluorspar, and cryolite	[5] 363	[5] 3,055	West Germany 2,955.
Fertilizer materials:			
Crude, phosphatic	------	[6] 20,000	All to Hungary.
Manufactured:			
Nitrogenous	[3] 61,000	[7] 62,407	Poland 52,000; Yugoslavia 4,796.
Phosphatic	------	[3] 23,000	All to Poland.
Graphite	1,281	------	
Magnesite [3] thousand tons	217	268	West Germany 119; Poland 54.
Stone, sand and gravel:			
Dimension stone	55,691	42,115	West Germany 26,117; Netherlands 7,615.
Gravel and crushed rock	45,755	54,110	All to West Germany.
Sand	10,366	10,489	All to Austria.
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Bituminous [3] thousand tons	2,327	2,420	East Germany 868; Hungary 588; Austria 344.
Lignite [3] do	1,138	1,159	West Germany 1,145.
Coke and semicoke [3] do	2,167	2,281	East Germany 621; Hungary 283; Rumania 172.
Gas, natural and manufactured do	16	118	Austria 99; Switzerland 10.
Petroleum:			
Partly refined oil do	113	175	All to Austria.
Refinery products do	829	929	Austria 339; Switzerland 339; West Germany 116.

[1] Because Czechoslovakia publishes only limited data on exports of mineral commodities, this table has been compiled from a variety of sources. Except where otherwise noted, 1967 information is from 1967 Supplement to the World Trade Annual. V. 1, East Europe. (Statistical Office of the United Nations). Walker and Co., New York, 1969, 360 pp. 1968 information is from 1968 Supplement to the World Trade Annual. V. 1, East Europe (Statistical Office of the United Nations). Walker and Co., New York, 1970, 430 pp.

[2] Statisticka Rocenka Ceskoslovenske Socialisticke Republiky, 1969 (Statistical Annual of the Czechoslovak Socialist Republic, 1969. Prague, 1969, 593 pp.

[3] Główny Urzad Statystyczny (Central Statistical Council). Rocznik Statystyczny Handlu Zagranicznego 1968 (Foreign Trade Annual for 1968). Warsaw, 1969, 430 pp.

[4] Official Czechoslovak sources listed the export of kaolin alone as follows: 1967—165,000 tons, 1968—170,000 tons. These figures duplicate in part data given in body of table, but include in 1968 45,000 tons of kaolin shipped to Poland and 14,000 tons of kaolin shipped to East Germany which are not included in the totals reported in Supplement to the World Trade Annual.

[5] Includes cryolite as follows: 1967—363, 1968—100, all to Poland (data from Polish trade returns); balance of material reported in Supplement to the World Trade Annual is identified as feldspar and fluorspar.

[6] Hungarian Central Statistical Office. Statistical Yearbook 1968. Budapest, 1970, 395 pp.

[7] Supplement to the World Trade Annual, and official trade returns of Poland.

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Table 3.—Czechoslovakia: Imports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum:			
Bauxite and concentrate [2 3] thousand tons	373	481	Hungary 296; Yugoslavia 96.
Oxide and hydroxide [3 4]	10,000	10,181	Hungary 9,000.
Metal, including alloys:			
Unwrought, including scrap [3 5 6]	31,004	47,999	U.S.S.R. 44,800.
Semimanufactures	r 14,221	17,753	U.S.S.R. 14,859.
Cadmium, metal, including alloys, all forms [5 6]	141	174	U.S.S.R. 163.
Chromium, chromite ore and concentrates [3 5] thousand tons	99	122	U.S.S.R. 60; Turkey 53.
Copper:			
Ore and concentrate [3]	4,357	947	All from Italy.
Metal, including alloys:.			
Unwrought [3 5]	r 32,000	38,169	U.S.S.R. 32,400; Belgium-Luxembourg 4,161.
Semimanufactures [3 5]	8,592	10,300	West Germany 6,220; Yugoslavia 2,206.
Iron and steel:			
Iron ore and concentrate thousand tons	10,366	11,147	U.S.S.R. 9,502; India 986.
Iron and steel scrap [6] do	------	37	All from Poland.
Pig iron, ferroalloys, and similar materials do	250	484	U.S.S.R. 459.
Steel semimanufactures [3 5 6] do	r 810	822	U.S.S.R. 395; Poland 174; West Germany 147.
Lead:			
Oxides [3]	3,217	3,464	Austria 1,810; France 1,173.
Metal, including alloys, all forms [3 5]	r 26,156	27,009	U.S.S.R. 25,200; Yugoslavia 1,809.
Magnesium metal, all forms [5]	1,232	1,375	All from U.S.S.R.
Manganese:			
Ore and concentrate thousand tons	306	412	U.S.S.R. 279; India 100.
Oxides [5]	900	2,100	All from U.S.S.R.
Mercury [3] 76-pound flasks	2,848	4,641	Spain 4,264.
Nickel, metal, including alloys, all forms	[5 6] 2,000	[5] 59	West Germany 55.
Tin:			
Oxides [3] long tons	34	32	All from West Germany.
Metal, including alloys, all forms [3] do	------	120	All from Netherlands.
Titanium, oxide [3]	597	901	Italy 535.
Tungsten, ore and concentrate [3]	------	75	All from West Germany.
Zinc:			
Dust (blue powder) [3]	1,597	2,684	All from Belgium-Luxembourg.
Metal, including alloys, all forms [3 5 6]	33,205	39,272	U.S.S.R. 16,800; Poland 12,674; Yugoslavia 8,405.
Other:			
Ores and concentrates, n.e.s. [3]	19,866	24,655	Finland 24,505.
Metals and alloys, n.e.s. [3]	65	62	Belgium-Luxembourg 58.
NONMETALS			
Asbestos	33,060	36,906	U.S.S.R. 20,509; Canada 8,189; Austria 3,712.
Barite [3]	1,920	1,870	All from West Germany.
Borates, crude, natural [3]	6,000	6,900	All from Turkey.
Cement [3 5 6] thousand tons	94	502	U.S.S.R. 399; Hungary 95.
Clays and clay products:			
Clays, crude, n.e.s. [3]	14,388	10,338	Yugoslavia 9,108.
Brick, refractory [3]	4,570	3,145	France 2,058; Austria 466; West Germany 454.
Feldspar and fluorspar [3]	1,404	1,020	All from France.
Fertilizer materials:			
Crude, phosphatic [5] thousand tons	481	476	All from U.S.S.R.
Manufactured:			
Nitrogenous, N content do	53	85	Austria 50; East Germany 9.
Phosphatic, P_2O_5 content do	297	291	U.S.S.R. 170; Lebanon 11.
Potassic, K_2O equivalent do	466	482	East Germany 428.
Graphite, natural [3 5]	r 328	481	U.S.S.R. 251.
Gypsum [5]	3,225	3,136	All from Poland.
Lime [6]	22,628	39,575	Do.
Magnesite [3]	1,500	7,000	All from Turkey.
Pyrite, gross weight thousand tons	95	80	U.S.S.R. 34; Poland [6] 25.
Salt:			
Rock	7,446	11,882	All from Poland.
Brine	15,858	16,419	Do.
Stone, sand and gravel:			
Dolomite [6]	3,094	3,095	Do.
Crushed stone [3]	1,726	2,801	Austria 1,530.
Sulfur:			
Elemental, all forms thousand tons	237	287	Poland 159; U.S.S.R. 45.
Sulfuric acid do	30	68	All from U.S.S.R.

See footnotes at end of table.

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Table 3.—Czechoslovakia: Imports of selected mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen [2]	49,328	58,995	All from Hungary.
Carbon black [3 4]	5,300	9,614	U.S.S.R. 3,900; France 3,582.
Coal, anthracite and bituminous thousand tons	4,162	12,718	Poland 10,617.
Coke and semicoke [5] do	91	59	All from U.S.S.R.
Gas, hydrocarbon, natural [6] million cubic feet	9,365	20,744	Do.
Petroleum:			
Crude [6] thousand tons	7,425	8,428	U.S.S.R. 8,380 (crude and products, not differentiated); Austria 34 (all lubricants); other Western Europe 11 (various refinery products).
Refinery products [3 6] do	544		

r Revised.

[1] Because Czechoslovakia publishes only limited data on imports of mineral commodities, this table has been compiled from a variety of sources. Entries appearing without a source footnote are from: Statisticka Rocenka Ceskoslovenské Socialisticke Republiky, 1969 (Statistical Annual of the Czechoslovak Socialist Republic, 1969). Prague, 1969, 593 pp. Sources of all other data are noted.

[2] Official trade returns of Hungary (exports to Czechoslovakia).

[3] Statistical Office of the United Nations. 1967 and 1968 editions of Supplement to the World Trade Annual. V. 1, East Europe. Walker and Co., New York (exports of the United States, Canada, Australia, Japan, Republic of South Africa, all non-Communist European countries, and Yugoslavia to Czechoslovakia).

[4] Official trade returns of Yugoslavia (exports to Czechoslovakia).

[5] Official trade returns of the U.S.S.R. (exports to Czechoslovakia).

[6] Official trade returns of Poland (exports to Czechoslovakia).

COMMODITY REVIEW

METALS

Iron and Steel.—About 90 percent of the industry's iron ore requirements are imported. Domestic ores average usually less than 35 percent iron content and the economic feasibility of operating these mines has been under scrutiny since 1963. Ore production maintained the same level of output as it did in 1968, in spite of continued shutdowns of marginal mines. At least three additional mines were closed during the year, Nova Stolna, Luciabana, and Dedicina Dobsina. Employees from these mines totaled less than 200 and were for the most part transferred to magnesite operations at Kosice.

The 2.3-percent increase in steel output was attributed to the expansion and modernization of the nation's major steelworks. The construction of a third double open-hearth furnace at the Klement Gotwald Steelworks at Ostrava was near completion by yearend. Smaller open-hearth furnaces at the Vitkovice Steelworks and the Trinec Steelworks continued to be replaced by larger capacity furnaces. Steel production by furnace type is listed in table 4. While electric furnace and oxygen converter (Linz-Donawitz) steels have shown appreciable growth in the last 3 years, open-hearth steel (including Maerz-Boelen furnaces) continued to supply about three-fourths of the total steel output. Estimated scrap consumption by the steel industry was approximately 5 million tons in 1969. Of this figure about 3.4 million tons was consumed in open-hearth steel production and about 1.3 million tons in electric steel output. Virtually all scrap requirements are met domestically. The scrap processing industry has launched an expansion program to increase output by an estimated 50 percent in 1975.

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Table 4.—Salient statistics on iron and steel production

		1966	1967	1968
PIG IRON				
Number of blast furnaces		22	20	19
Production of pig iron and ferroalloys:				
Pig iron for steelmaking	thousand metric tons	5,559	6,255	6,439
Pig iron for foundry	do.	661	521	432
Blast furnace ferroalloys	do.	49	46	49
Electric furnace ferroalloys	do.	91	97	100
Total	do.	6,360	6,919	7,020
Materials consumed per ton of pig iron:				
Iron ore and manganese ore	kilograms	504	428	361
Sinter	do.	1,329	1,444	1,571
Scrap	do.	52	44	40
Coke	do.	684	651	637
Limestone	do.	220	178	172
INGOT STEEL				
Production of crude steel:				
Open hearth	thousand metric tons	7,402	7,441	7,493
Bessemer	do.	242	247	246
Electric furnace	do.	1,209	1,254	1,272
Oxygen converter	do.	275	1,060	1,544
Total	do.	9,128	10,002	10,555
Materials consumed per ton of crude steel:				
Pig iron	kilograms	599	623	632
Scrap	do.	479	472	462

Uranium.—The general directorate of the Czechoslovak uranium industry rescinded the August 22, 1968, declaration which halted the production of uranium ore for delivery to the U.S.S.R. Ores were mined at Pribram and Dolni Rozince. The entire output was exported to the U.S.S.R.

NONMETALS

Clays, Kaolin.—The kaolin industry maintained its steady growth pattern in 1969 satisfying domestic consumption requirements and placing about 150 to 200 thousand tons on the export market.

The bulk of kaolin production is derived from deposits at Karlovy Vary, Plzen, and Podborany. The Karlovy Vary area clays are characterized by high-strength and heat-resistant properties particularly suitable for high-quality porcelain. Extensive development of the area has been undertaken. The new flotation plant at Bozicany continued under construction with operation scheduled for 1972. Other flotation plants in the Karlovy Vary area include Sadov, Osmosa, Kaolina, and Marketa. Clays of the Plzen area do not exhibit the high-strength qualities of Karlovy Vary clays; however, their whiteness affords them particular suitability as fillers. Flotation plants in the area include Horni Briza, Chlumcany, and Ledce. A new flotation plant was under construction at Kaznejov. The effective operating date was not reported. Clays of the Podborany region exhibit high strength but are difficult to fluidize. The clays are principally used in the ceramic industry. Flotation plants in the area include Nepomysl, Buskovnice, and Kadan.

Fertilizers and Fertilizer Materials.—The Czechoslovak fertilizer industry satisfied about 75 percent of the nation's requirements for nitrogenous fertilizers and about one-half of its requirements for phosphatic fertilizers. Most of the raw material requirement for the manufacture of phosphatic fertilizers is imported from the U.S.S.R. as phosphate rock. The nation's total requirements for potassic fertilizers are met by imports, principally from East Germany.

Contracts for construction of additional ammonia and urea units at the Sala Nad Vahom fertilizer plant in southwest Slovakia were awarded to Friedrich Uhde G.m.b.H. The expansion program will include construction of a 350,000-ton-annual-capacity steam-reforming ammonia plant and a 198,000-ton-annual-capacity Stamicarbon process urea plant. The completion date was scheduled for 1972.

A contract for construction of additional urea production facilities was also awarded Continental Engineering (Netherlands) and

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Klöckner Industrie Anlagen G.m.b.H. (West Germany). The contract calls for an investment of US$7 million for an urea plant of 200,000-ton annual capacity to be commissioned by late 1971 at the Zaluzi Fertilizer Complex near Most in northern Czechoslovakia.

Magnesite.—Czechoslovak magnesite reserves were reported in excess of 1 billion tons. The current production level surpasses domestic consumption requirements and affords significant quantities of magnesite clinker and magnesite brick for export. The mining and processing industry is controlled organizationally by the Slovak Magnesite Complex at Kosice employing about 1,900 workers in 1969. The complex controls eight units; five are concerned with mining and processing magnesite, two are engaged in processing fire clays (Kalinovo and Poltar deposits), quartz sands, and the manufacture of silica refractory products, and the remaining unit at Kunova Teplice is an engineering group.

The industry has been undergoing expansion. Three additional kilns were installed at Jelsava during 1967–69. Construction continued on the 1.5 million-ton-annual-capacity Mikova mine near Jelsava. No production date for the mine has yet been announced. Within the next decade, Czechoslovakia has slated US$250 million for investment in the magnesite industry.

Perlite.—Perlite mining operations have been underway in Czechoslovakia since 1966. Apparently all of the perlite output is derived from the Lehotka pod Brehy mine and processing plant operating at a 10,000-ton-per-year-capacity level. A second plant was under construction in 1969, probably near Byst in eastern Slovakia. Equipment for this 50,000-ton-per-year-capacity plant will be supplied by the Federal Republic of Germany. Approximately half of the plant output will be exported. Perlite expansion plants are located in principal consuming areas including Bratislava, Cheb, Kosice, Lohotka pod Brehy, Michalovce, Mnisek, Novy Jicin, and Prague.

MINERAL FUELS

Solid fuels maintained their position as the nation's primary energy source. Production of brown coal, a major energy source for Czechoslovakia's electric power industry, increased by 6 percent. Bituminous coal output increased by 5 percent, affording that industry its first significant production recovery since the adoption of the 1965 industrial reforms requiring the shutdown of marginal mines and increased mechanization in remaining collieries. The increased production was, however, not sufficient to offset Czechoslovakia's fuel and power shortages. The Ostrava Karvina basin yielded 82 percent, or 22.15 million tons, of the total 1969 bituminous coal output, approaching its peak level production of 1964 with 20,000 fewer miners than were employed at the basin in that year.

Petroleum and natural gas, principally imported, shared an increasing role in the nation's primary energy consumption as reflected in the percentages tabulated below:

Fuel type	1960	1965	Plan 1970	Plan 1975
Solid fuels	89.0	82.1	75.0	64.9
Liquid fuels	6.3	13.1	18.8	26.7
Natural gas	2.6	1.4	3.4	5.9
Hydropower	2.1	2.6	1.8	1.4
Nuclear Power	----	.8	.8	.8
Imported electric power	----	.8	1.0	.8

Crude imports from the U.S.S.R. totaled 8.5 million tons in 1969. Soviet crude imports will soon be supplemented by crudes imported from the Middle East. By agreement concluded in 1969 Iraq contracted with Techno-Export of Czechoslovakia to build an oil refinery at Basrah. The cost of the project, estimated at US$32 million, will be repaid by Iraq crude oil exports to Czechloslovakia. The agreement includes Iraqi National Oil Co. financial participation in a crude oil pipeline from the Yugoslav port of Rijeka to Hungary, Czechoslovakia, and Poland.

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The Mineral Industry of Finland

By F. L. Klinger [1]

Finland's mineral industry continued to expand in 1969. Increased production, consumption, and trade were noted in all sectors of the industry because domestic and foreign demand remained strong. A revival of building construction, continuing controls on wages, prices, and taxes, and removal of the export tax were contributing factors.

New mines, already producing or in advanced stages of construction, were increasing productive capacity for copper, nickel, chromite, pyrite and sulfur, talc, and construction materials. The country's first zinc smelter was completed in December. A new steelworks was under construction at Koverhar, as were rolling mills at Raahe and Hämeenlinna, and an important merger took place between two privately owned iron and steel companies. Several new plants for manufacturing sulfuric acid and other fertilizer materials was completed or under construction. A new cement works was operated in the arctic region. In the fuels sector, new plants were being added to the Porvoo refinery complex, a petrochemicals company was formed, and an agreement was reached for constructing a nuclear powerplant at Loviisa. Imports of fuels were at record levels, and for the first time, oil provided more than 50 percent of the nation's energy requirements.

Finland joined the Organization for Economic Cooperation and Development (OECD) in 1969.

[1] Physical scientist, Bureau of Mines, Washington, D.C.

PRODUCTION

Production indices for major sectors of the mineral industry, for 1968 and the first 10 months of 1969, were as follows:

Sector	(1959 = 100) 1968	1969
Mining and quarrying	147	167
Basic metal industries	270	314
Nonmetallic mineral processing	219	245
Chemical industry	247	• 250
Petroleum refining	561	• 660
All industry	182	197

• Estimate.

Principal source: Central Bureau of Statistics (Helsinki). Bulletin of Statistics (Tilastokatsauksia); No. 12, 1969.

Table 1.—Finland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Chromium:			
Chromite concentrates, gross weight	6,384	36,196	71,326
Chromic oxide content	2,815	14,949	30,100
Cobalt:			
Mine output, metal content •	1,800	1,700	1,650
Metal	17	505	778

See footnote at end of table.

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Table 1.—Finland: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS—Continued			
Copper:			
Mine output, metal content	29,836	30,188	• 33,250
Metal, electrolytic	34,173	35,895	33,877
Gold, metal, troy ounces	20,281	21,380	18,872
Iron and steel:			
Iron ore:			
Magnetite concentrate, thousand tons	642	• 510	588
Pelletized iron oxide (from pyrite), do	299	341	296
Roasted pyrite (purple ore), do	39	101	123
Pig iron, do	1,017	1,039	1,162
Ferrochromium, do	-------	8	26
Steel, crude, do	411	700	951
Semimanufactures, do	340	554	712
Lead, mine output, metal content	4,786	4,524	4,553
Nickel:			
Mine output, metal content	3,458	3,326	3,625
Metal, electrolytic	3,003	3,327	3,722
Sulfate, metal content	160	177	191
Rare-earth metals:			
Lanthanide concentrate, gross weight	14,127	12,152	10,117
Oxide content	500	402	355
Selenium, metal, kilograms	6,696	7,296	6,197
Silver, metal, troy ounces	623,000	677,000	625,000
Titanium concentrate (ilmenite), gross weight	126,900	r 139,500	138,200
Vanadium pentoxide	2,093	2,139	2,403
Metal content	1,172	1,198	1,846
Zinc:			
Mine output, metal content •	60,800	65,400	71,200
Metal	-------	-------	1,084
NONMETALS			
Asbestos	10,524	r 12,334	12,448
Cement, hydraulic, thousand tons	1,514	1,476	1,759
Diatomite	1,619	1,980	1,820
Feldspar	r 54,744	54,427	• 63,000
Fertilizers, manufactured:			
Nitrogenous, thousand tons	NA	NA	188
Phosphatic, do	395	• 320	• 215
Other, do	NA	NA	934
Lime, do	230	210	218
Limestone, all types, do	3,269	r 3,726	• 4,000
Pyrite:			
Gross weight, do	712	774	• 803
Sulfur content, do	341	371	• 378
Quartz	61,000	65,000	• 70,000
Sulfur, byproduct (recovered):			
Elemental	101,418	125,249	111,841
Gaseous (in SO_3)	181,891	205,088	192,846
Talc and soapstone:			
Talc	2,562	2,476	• 30,000
Soapstone, cubic meters	150	• 200	NA
Wollastonite	3,890	4,296	5,200
MINERAL FUELS AND RELATED MATERIALS			
Coke, all types, thousand tons	136	• 125	• 127
Fuel briquets, do	25	26	30
Gas, manufactured, million cubic feet	2,560	r 2,108	2,362
Peat, for fuel use, thousand tons	• 100	• 100	109
Petroleum refinery products: [1]			
Gasoline, thousand tons	941	r 1,072	1,309
Kerosine and jet fuel, do	42	r 78	81
Distillate fuel oil, do	3,113	{1,680	4,420
Residual fuel oil, do		{2,261	
Liquefied petroleum gases, do	56	r 53	49
Bitumen and other	295	339	876
Total refinery products, do	4,447	r 5,483	6,735
Total crude oil processed, do	4,657	5,990	7,052

• Estimate. r Revised. NA Not available.

[1] Source for 1968 data: OECD (Paris). Oil Statistics.

TRADE

Finland's total commodity trade showed a slight deficit in 1969, amounting to approximately $36 million.[2] A surplus of $44 million was realized in 1968. Trade in mineral commodities, however showed a

[2] Where necessary, values have been converted from Finnish markkas (Fmk) to U.S. dollars at the rate of Fmk. 4.2=US$1.00.

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Table 2.—Finland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum metal, including alloys, all forms	2,648	4,025
Copper:		
Matte	215	NA
Metal, including alloys:		
Unwrought	11,922	10,825
Semimanufactures	12,200	13,029
Iron and steel:		
Ore and concentrate, except roasted pyrite	121,501	170,623
Roasted pyrite	5,619	14,352
Metal:		
Scrap	4,906	10,470
Pig iron, including cast iron	791,918	684,908
Steel, primary forms	2,448	344
Semimanufactures	57,300	159,095
Lead ore and concentrates	7,545	9,399
Nickel metal, including alloys:		
Unwrought	2,648	2,925
Semimanufactures	21	-------
Platinum-group metals and silver: Metal, including alloys, value, thousands	$343	$346
Selenium, elemental	5	6
Tin metal, including alloys, all forms, long tons	11	8
Titanium:		
Ore and concentrate	40,431	45,889
Oxides	5,128	4,287
Vanadium oxides	2,491	2,572
Zinc:		
Ore and concentrate	115,327	125,947
Metal scrap	134	377
Other:		
Ashes and residues containing nonferrous metals	1,222	8,274
Oxides, hydroxides, and peroxides of metals, n.e.s.	1,993	NA
Metals, including alloys, all forms:		
Alkali and rare-earth metals	53	
Base metals, n.e.s.	169	375
NONMETALS		
Asbestos	8,849	10,322
Cement	12,303	82
Clay products, value, thousands	$307	$237
Diatomite and other infusorial earths	98	28
Feldspar	31,135	45,255
Fertilizer materials, manufactured	16,864	49,057
Lime	1,505	-------
Mica, all forms	25	44
Precious and semiprecious stones, except diamond, value, thousands	$21	NA
Pyrite (gross weight)	31,311	45,637
Stone, sand and gravel:		
Dimension stone	9,887	12,287
Limestone (except dimension)	6,465	10,675
Sand, gravel, and other crushed rock		10,967
Quartz and quartzite	NA	NA
Sulfur:		
Elemental forms	7,710	NA
Sulfuric acid	15,828	32,598
Other nonmetals, n.e.s.:		
Slag, dross and similar waste, not metal-bearing	NA	NA
Other	67	NA
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets	13,203	1,878
Coke and semicoke	6,710	14,027
Gas, hydrocarbon	9,502	5,682
Peat and peat briquets	502	680
Petroleum refinery products:		
Gasoline	• 164,000	97,127
Distillate fuel oil	24,953	1,956
Residual fuel oil	104,708	34,851
Lubricants	94	380
Other	• 625	797

• Estimate. NA Not available.

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deficit of $352 million, an increase of $52 million compared with the previous year. Exports of mineral commodities rose by $34 million, generated mainly by increases in iron, steel, nonferrous metals, and petroleum products, while the value of imports increased by $83 million, due mainly to heavy increases in steel semimanufactures and crude oil.

The Government tax on exports, which was established at the time of devaluation in late 1967, was discontinued in April, 1969.

Table 3.—Finland: Principal destinations of selected mineral commodity exports, 1968

(Thousand metric tons, unless otherwise specified)

Commodity	Quantity
Copper metal,[1] total	24
Common Market	9
Sweden	6
Iron and steel:	
Iron ore, total	171
Czechoslovakia	98
Pig iron, total	685
Sweden	164
Italy	146
United Kingdom	126
United States	80
Argentina	75
Semimanufactures, total	159
United Kingdom	68
Sweden	36
Common Market	32
Nickel, unwrought, total metric tons	2,925
Sweden do	667
Common Market do	1,791
Zinc ore and concentrate, total	126
Belgium-Luxembourg	60
West Germany	43
Petroleum products, total	135
United Kingdom	114

[1] Unwrought and semimanufactures, including alloys.

Table 4.—Finland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Ore and concentrate	7,786	NA
Oxide and hydroxide	16,726	12,289
Metal, including alloys:		
Unwrought	14,461	12,262
Semimanufactures	13,782	14,362
Antimony metal, including alloys, all forms	50	39
Arsenic trioxide, pentoxide and acids	422	NA
Chromium:		
Chromite	455	1,243
Oxide and hydroxide	319	NA
Cobalt:		
Oxide and hydroxide	3	NA
Metal, including alloys, all forms	NA	4
Copper metal, including alloys:		
Scrap	2	-------
Unwrought	6,628	8,165
Semimanufactures	4,335	3,662
Gold metal, unworked or partly worked troy ounces	96,227	NA
Iron and steel:		
Ore and concentrate, except roasted pyrite	637,895	628,272
Roasted pyrite	3,192	3,505
Metal:		
Scrap	111,861	67,904
Pig iron, including cast iron	4,797	726
Sponge iron, powder and shot	1,979	3,303
Ferroalloys	10,914	14,832
Steel, primary forms	51,210	20,521
Semimanufactures:		
Bars, rods, angles, shapes, sections	120,952	160,963
Universals, plates and sheets	411,020	304,327
Hoop and strip	24,747	27,958
Rails and accessories	1,296	298
Wire	15,591	12,475
Tubes, pipes, and fittings	83,142	77,733
Castings and forgings, rough	NA	230
Lead:		
Oxides	533	464
Metal, including alloys:		
Unwrought	8,529	8,521
Semimanufactures	840	1,596
Magnesium metal, including alloys, all forms	36	9
Manganese:		
Ore and concentrate	11,859	44,777
Oxides	580	651

See footnote at end of table.

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Table 4.—Finland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS—Continued		
Mercury, 76-pound flasks	638	493
Molybdenum metal, including alloys, all forms	2	4
Nickel:		
Ore and concentrate	540	NA
Metal, including alloys:		
Scrap	80	186
Unwrought	242	130
Semimanufactures	236	172
Platinum-group metals, thousand troy ounces	2,750	NA
Silver metal, including alloys, do	-------	6,687
Silicon, elemental	143	NA
Tin:		
Oxides, long tons	16	NA
Metal, including alloys:		
Unwrought, do	237	243
Semimanufactures, do	32	NA
Titanium oxides	10	22
Tungsten metal, including alloys, all forms	3	5
Zinc:		
Oxides	331	362
Metal, including alloys:		
Blue powder	222	239
Unwrought	6,741	5,482
Semimanufactures	388	483
Other:		
Ore and concentrate of:		
Titanium, vanadium, tantalum, and zirconium	57,019	NA
Base metals, n.e.s	35	NA
Ash and residue containing nonferrous metals	489	241
Metals, including alloys, all forms:		
Metaloids, n.e.s	42	NA
Pyrophoric alloys	2	NA
Base metals, n.e.s	108	108
NONMETALS		
Abrasives, natural, n.e.s, value, thousands	$212	$211
Asbestos	6,431	4,540
Barite and witherite	646	NA
Borates, crude, natural	2,539	NA
Cement	7,475	7,332
Chalk	10,209	9,706
Clay and clay products (including all refractory brick):		
Crude clays	245,877	235,057
Clay products:		
Refractory (including brick)	46,067	37,186
Nonrefractory, value, thousands	$637	$718
Cryolite and chiolite, natural	62	NA
Diamond:		
Gem, not set or strung, value, thousands	$190	$256
Industrial, do	$143	$108
Feldspar	1,264	NA
Fertilizer materials:		
Crude, phosphate	351,834	455,666
Manufactured:		
Nitrogenous	77,215	67,564
Phosphatic:		
Thomas (basic) slag	13,686	11,513
Other	-------	-------
Potassic	180,579	201,918
Other, including mixed	1,145	2,493
Ammonia	20,260	20,871
Fluorspar	4,356	NA
Graphite, natural	346	NA
Gypsum and plasters	114,739	122,335
Lime	16	13
Magnesite	2,059	NA
Mica, all forms	521	NA
Pigments, mineral:		
Natural, crude	600	714
Iron oxides, processed	1,253	1,300
Precious and semiprecious stone, except diamond:		
Natural, value, thousands	$239	$176
Manufactured, do	$195	$127
Salt (excluding brine)	352,344	434,670
Sodium and potassium compounds, n.e.s.:		
Caustic soda	5,403	18,687
Caustic potash	296	237
Stone, sand and gravel:		
Dimension stone	2,164	2,827
Dolomite, chiefly refractory grade	3,778	NA
Gravel and crushed rock	4,226	NA
Limestone, except dimension	224,919	234,305
Quartz and quartzite	1,699	1,273
Sand, excluding metal-bearing	84,640	88,957

See footnote at end of table.

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Table 4.—Finland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
NONMETALS—Continued			
Sulfur:			
Elemental		51,235	34,151
Sulfuric acid		30	27
Talc and steatite		4,919	4,381
Other nonmetals, n.e.s.:			
Slag, dross and similar waste, not metal-bearing:			
From manufacture of iron and steel		5,925	NA
Slag and ash, n.e.s.		2,300	NA
Other mineral materials		1,231	NA
Oxides and hydroxides of magnesium, strontium and barium		6,812	5,772
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		815	860
Carbon black		3,172	3,732
Coal, all grades, including briquets	thousand tons	2,059	2,094
Coke and semicoke	do.	736	662
Gas, hydrocarbon, liquefied	do.	6	9
Petroleum:			
Crude and partly refined	do.	4,970	5,814
Refinery products:			
Gasoline	do.	102	49
Kerosine	do.	26	30
Distillate fuel oil	do.	1,861	1,943
Residual fuel oil	do.	978	934
Lubricants	do.	68	67
Other	do.	223	235
Mineral tar and other crude chemicals derived from coal, petroleum or gas	do.	17	14

NA Not available.

Table 5.—Finland: Principal sources of selected mineral commodity imports, 1968

(Thousand metric tons)

Commodity	Quantity
Aluminum metal, [1] total	27
U.S.S.R.	7
Sweden	6
Norway	4
Copper metal, [1] total	12
Zambia	4
Chile	3
Iron ore, total	628
Norway	421
Sweden	189
Iron and steel semimanufactures, total	584
Sweden	96
U.S.S.R.	84
United Kingdom	68
Fertilizer materials:	
Phosphatic, crude, total	456
U.S.S.R.	294
Morocco	147
Potassic, manufactured, total	202
U.S.S.R.	69
West Germany	69
East Germany	55
Salt, total	435
Netherlands	184
East Europe	167
Coal, total	2,094
Poland	1,662
U.S.S.R.	427
Petroleum, crude, total	5,814
U.S.S.R.	5,197
Iran	617
Petroleum products, total	3,272
U.S.S.R.	2,638
Venezuela	192
Rumania	189

[1] Unwrought and semimanufactures, including alloys.

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COMMODITY REVIEW

METALS

Chromium.—Output of chromite from the Elijärvi deposits near Kemi was almost doubled in 1969. The mine concentrator was completed in midyear, and the ferrochromium plant at Tornio had its first full year of production. Crude ore production totaled 212,000 tons. Increased output was expected in 1970.

The concentrator has a processing capacity of about 400,000 tons of crude ore per year. A single stage of autogenous grinding is used to reduce the ore to a fineness of 40 percent through 200 mesh, after which it is deslimed, dried, and concentrated by high-intensity magnetic separators. The concentrate has a fineness of 20 percent through 200 mesh and contains 98 percent chromite. The chromite has a Cr:Fe ratio of approximately 1.7. Part of the concentrate will be sold as foundry sand, but most will be smelted at Tornio. (See Ferrochromium).

Cobalt.—Output of cobalt metal at Kokkola in 1969 was approximately 65 percent of the plant's rated capacity. The principal source of cobalt was pyrite concentrate produced at the Outokumpu mine, which contains approximately 0.7 percent cobalt. Byproducts of the plant include iron oxide (purple ore), and small quantities of copper, nickel, and zinc. The nonferrous metals are precipitated as sulfides from cobaltous sulfate solution.

In addition, 212 tons of cobalt hydroxide were reportedly produced, probably from the nickel refinery at Harjavalta.

Copper and Nickel.—Increased output of mine copper in 1969 was due to the first full year of production at the Luikonlahti mine, 25 miles northwest of Outokumpu. The mine, which is owned by a private concern, Myllykosken Paperitehdas Oy., produced 21,000 tons of copper concentrate which was sold to Outokumpu Oy. Pyrrhotite concentrate was sold to Rikkihappo Oy. for production of sulfuric acid at Siilinjärvi. Crude ore reserves at Luikonlahti were reportedly 8 million tons, enough for 20 years at the expected rate of production. The ore contains 1 to 1.5 percent copper, 0.8 to 1 percent zinc, and 22 percent sulfur. Nickel and cobalt are also reported to occur in the ore.

Open pit mining of copper ore at the Virtasalmi mine was stopped in mid-1969, to allow the mine concentrator to process nickel-copper ore from a new mine at Telkkälä. The mine was opened in 1969 by the Outokumpu company, producing 18,260 tons of nickel concentrates (3.5 percent Ni) and 251 tons of copper concentrates. The Telkkälä ore contains about 1 percent nickel and 0.3 percent copper. Further details were not available.

Mining of nickel-copper ore at Hitura, about 60 miles east of Kokkola, was scheduled by Outokumpu Oy. to begin in July 1970. The Hitura deposits, which have been under development for several years were reported in 1964 to contain at least 5 million tons of ore with an average metal content of 0.7 percent Ni and 0.26 percent Cu. Similar ore was formerly produced in this district at the Makola mine, yielding concentrates containing approximately 5.5 percent nickel, 3.5 percent copper, and 0.4 percent cobalt.

Development of the Vuonos mine, 3 miles east of Outokumpu, was continued in 1969. Mining of nickel ore by open pit methods was scheduled to begin in late 1971, at the rate of 1.5 million tons annually; underground, production of copper ore was to start a year later, at the rate of 300,000 tons annually. This mine will be the largest in Finland, annually producing about 2,000 tons of nickel, 9,000 tons of copper, 72,000 tons of cobaltiferous pyrite, and small quantities of zinc. Minimum reserves of nickel ore were 20 million tons; no figure was available for copper ore reserves. Investment by Outokumpu Oy. in development of the Vuonos deposit was estimated at more than $20 million.

Nickel concentrates processed at the Harjavalta smelter in 1969 included 5,000 tons of purchased material, probably imported from Norway. Since 1967, A/S Titania, the Norwegian producer of ilmenite, has produced a nickel concentrate similar in nickel content (5.5 percent) to that produced in Finland at the Kotalahti mine. The Norwegian concentrate has been exported to Finland.

Iron and Steel.—Most of Finland's iron and steelmaking capacity in the private sector was consolidated under a single company in 1969. The new company, known as Ovako, was formed by a merger

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of Oy Vuoksenniska Ab with Oy Fiskars Ab. Ovako plants, which include the works at Imatra, Turku, Koverhar, and Ammine-fors, had an aggregate annual production capacity of 450,000 tons of pig iron, 350,000 tons of crude steel, and 350,000 tons of rolled products in 1969. This represents more than 90 percent of primary capacity in the private sector. Production capacity of the largest remaining independent firm, Oy Wärtsilä Ab, was approximately 20,000 tons of synthetic pig iron and 60,000 tons of steel, based largely on purchased metal.

Iron Ore.—The Otanmäki and Raajärvi underground mines continued to account for all production of magnetite concentrate. Compared with 1968, output from Otanmäki rose 12 percent to 274,800 tons, while that from Raajärvi increased 19 percent to 312,900 tons. Both mines are owned and operated by Rautaruukki Oy., the State-controlled iron and steel company. The remaining 419,000 tons of iron oxide concentrate was obtained from pyrite at the Kokkola works of Outokumpu Oy. Imports of iron ore in 1969 totaled 1.2 million tons; exports were 225,000 tons.

Iron deposits in the Kolari district of north Finland, near the Swedish border, were being developed by Rautaruukki Oy. Mining was scheduled to begin in 1974. The company has been investigating the iron ores of this area for several years.

Ferrochromium.—Output of the new ferrochromium plant near Tornio in 1969 was approximately 90 percent of production capacity.Average chromium content of the product was 57 percent.

The plant is located 25 miles west of the chromite mine near Kemi. Mine concentrate is reground at the plant to 80 percent through 200 mesh, then pelletized and sintered before charging into a 15,000 kilovolt-ampere electric furnace. The furnace has a production capacity of 28,000 metric tons of ferrochromium annually, requiring about 70,000 tons of chromite concentrate.

Exports of ferrochromium increased to nearly 20,000 tons, compared with 600 tons in 1968. The product was marketed through Metall und Rohstoff A.G. of Zug, Switzerland.

Pig iron.—Virtually all of the increase in output of pig iron in 1969 was due to a 20-percent rise in production at the Raahe works of Rautaruukki Oy. Production from blast furnaces at Turku and Kovarhar was approximately the same as in 1968, but ironmaking capacity at each of these plants was being increased by 50,000 tons. By 1971, annual capacity at Turku will increase to 200,000 tons and that at Koverhar will increase to 350,000 tons.

With increasing domestic demand, exports of pig iron continued to decline. Exports were 118,000 tons less than in 1968. This trend was expected to continue, with a drastic reduction expected in 1971 when the steelworks at Koverhar is completed.

Steel.—Output of crude steel from the oxygen steelworks at Raahe increased by 66 percent in 1969, to 526,000 tons or about 80 percent of capacity. The Ovako company produced 246,000 tons from electric furnaces at Imatra and 103,000 tons of open hearth steel at Ämminefors.

Steelmaking capacity of Ovako will increase by about 280,000 tons annually in 1971, when the Koverhar works is completed. Two 50-ton Linz-Donawitz (LD) converters and two 4-strand continous casting machines were being installed. This project will increase Ovako steelmaking capacity to 630,000 tons annually, nearly equal to the capacity of the State-owned steelworks at Raahe. The Koverhar works is partly owned by the Stora Kopparbergs Bergslags company of Sweden.

Oy. Wärtsilä Ab was adding a new electric steel furnace at its Taalintehdas (Dalsbruk) works. The furnace will increase steelmaking capacity of the plant by 40,000 tons annually.

Steel Semimanufactures.—Output of rolled steel products by Ovako was 319,000 tons, most of which was delivered to the home market. The Imatra plant produced 206,000 tons and the remainder was produced at Ämminefors. At Raahe, 329,000 tons of steel plate was produced from 478,000 tons of cast slab.

Construction of a hot-rolling mill for sheet, with an annual capacity of 230,000 tons, was continued at Raahe by Rautaruukki Oy. The company also began construction of a cold-rolling mill at Hämeenlinna, with an annual capacity of 200,000 tons. Galvanizing lines were also being built at Hämeenlinna. Both rolling mills were scheduled for completion by 1972.

Total exports of steel increased by 88,000 tons compared with 1968. Exports of ingots, slabs, and other crude forms rose by 46,000 tons; exports of sheets and plates

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increased by 36,000 tons. Total imports of steel increased by 102,000 tons, of which the largest item was a 40,000-ton rise in imports of bars, rods, and sections.

Rare-Earth Metals.—Typpi Oy. continued to recover rare-earth compounds, partly from lanthanide concentrates produced in Finland and partly from apatite imported from the Soviet Union. Sales of rare-earth compounds by the company in 1969 totaled 189 tons, compared with 58 tons in 1968. From its research on the practical application of rare earths, the company regarded the manufacture of europium-yttrium-vanadate lamp bulbs as technically feasible.

Titanium.—Exports of ilmenite concentrate declined to 13,000 tons in 1969, the lowest level in many years. This was due possibly to increased domestic requirements, as the capacity of the Vuorikemia Works of Rikkihappo Oy. was reportedly increased by 50 percent to an estimated 45,000 tons of titanium dioxide annually. More than 80 percent of the output of this plant is exported, and the parent company stated that in 1969, exports of titanium dioxide accounted for 10 percent of all international trade in this commodity. Exports of titanium dioxide and pigment totaled 31,000 tons in 1969 and were valued at approximately $11 million.

Vanadium.—A 10-percent increase in output of vanadium-bearing magnetite concentrate at the Otanmäki mine was responsible for the 12-percent rise in output of vanadium pentoxide in 1969. Exports of vanadium compounds rose to 2,779 tons, valued at $4.4 million. Rikkihoppo Oy., the State-owned chemical company, was producing a vanadium compound for use as a catalyst in manufacture of sulfuric acid.

Zinc.—Zinc was refined from domestic ores for the first time in 1969, as the zinc plant at the Kokkola works of Outokumpu Oy. was completed in December. Nominal output capacity of the plant was 90,000 tons annually of zinc analyzing 99.995 percent Zn. Byproduct metals will include cadmium, to be refined at Kokkola, and a copper residue, to be processed at Harjavalta. About 90 percent of the zinc will be exported.

Finland's output of zinc concentrates, currently running about 130,000 tons annually, has been exported mainly to Belgium and West Germany. Exports to all countries in 1969 totaled 134,000 tons valued at nearly $9 million.

NONMETALS

Asbestos.—Although reported production of asbestos was essentially unchanged from the 1968 level, exports increased by 16 percent to nearly 12,000 tons in 1969.

Anthophyllite was the only type of asbestos produced. All production apparently came from the Paakkila open pit mine, east of Kuopio, operated by Paraisten Kalkkivuori Oy. This mine employed 17 workers in 1968, producing 269,000 tons of rock, from which 25,000 tons of concentrating ore was obtained. About 95 percent of the asbestos produced was of fiber grade; the remainder was flour.

Cement and Other Construction Materials.—The rise in output of cement in 1969 reflected a recovery in building construction after 2 years of static conditions. Investment in industrial, commercial, and residential construction was considerably above the level of 1968, and the volume of buildings completed increased by 19 percent. Production in the clay, glass, and stone-processing industries accelerated throughout the year and was 13 percent greater than in 1968. Exports of nonmetallic mineral products also increased, particularly glass and cement.

A new cement plant, with an annual production capacity of 200,000 tons, was operated by Paraisten Kalkkivuori in 1969. The plant is located at Kolari, about 65 miles north of the arctic circle.

Feldspar and Quartz.—Increased output of feldspar and quartz appeared to be due mainly to activities of Lohjan Kalkkitehdas Oy. The company produced 50,000 tons of feldspar and 46,000 tons of quartz in 1969, compared with 43,000 tons and 38,000 tons, respectively, in 1968. The company's main operations were at Kemiö, where a new flotation mill began processing pegmatite in 1967, and at Nilsiä, where a sericitic quartzite is quarried. Crude ore production in 1968 was 85,000 tons at Kemiö and 49,000 tons at Nilsiä.

Paraisten Kalkkivuori Oy. accounted for the rest of the nation's output, from mines at Haapaluoma, Kaatiala, and at Kankanpää where a new quartz mine was opened in 1969.

Fertilizer Materials.—Technical and economic research by Apatiiti Oy. on large,

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low-grade (10 percent P_2O_5) deposits of apatite near Siilinjärvi, indicated that exploitation would be uneconomic at the present time. Plans to develop the deposits were postponed indefinitely. The separation of apatite from calcite was reported to be difficult.

Rautaruukki Oy. continued investigations of apatite deposits in the Savukoski area of Lapland.

A new fertilizer works was brought on stream by Rikkihappo Oy. at Siilinjärvi in 1969. The works includes a sulfuric acid plant (capacity 230,000 tons monohydrate per year) a phosphoric acid plant (75,000 tons P_2O_5 per year), and monoammonium phosphate plant (150,000 tons per year). The monoammonium phosphate will be used as raw material in the production of concentrated compound fertilizers in the company's plants at Kotka, Kokkola, and Harjavalta. Mineral raw materials for the Siilinjärvi works include pyrrhotite from the Luikonlahti mine, and apatite from the Kola deposits of the U.S.S.R.

A new ammonia plant was completed at Oulu by Typpi Oy. in 1969. The plant has a production capacity of 250,000 tons annually, using naphtha as raw material. The Oulu works supplied about 240,000 tons of fertilizers to the Finnish market in 1969, about 20 percent of the total supply. While nitrogenous fertilizer is the principal product, the works also consumed 37,000 tons of apatite and 25,000 tons of potassium salts.

Imports in 1969 included 507,000 tons of crude phosphate and 182,000 tons of potassium salts. Consumption was approximately 153,000 tons nitrogen, 173,000 tons P_2O_5, and 132,000 tons K_2O.

Pyrite and Sulfur.—The rise in production of pyrite in 1969 was due mainly to increased processing of old tailings at Outokumpu. No figures were available for pyrrhotite produced at the Luikonlahti mine, nor of the sulfur recovered from this material as acid at Siilinjärvi.

Rikkihappo Oy. was expanding its production capacity for sulfuric acid at both Kokkola and Harjavalta by 90,000 tons annually. The new plant at Harjavalta was scheduled for completion in the fall of 1970. Expansion of the Kokkola plant will probably be completed in 1971. At both localities, the company uses sulfur dioxide obtained from smelters of Outokumpu Oy. Output of sulfuric acid by Rikkihappo in 1969 increased to 675,000 tons, compared with 596,000 tons in 1968.

A plant for recovery of sulfur was scheduled to be installed at the Porvoo petroleum refinery by 1972.

MINERAL FUELS

Coal and Coke.—Imports of solid fuels rose 17 percent above the 1968 level, due mainly to a heavy increase in consumption for power generation and space heating. Imports included 2.46 million tons of coal and 762,000 tons of coke. Consumption of coal and coke in 1968 and 1969 is shown in the following tabulation, in thousand metric tons:

	1968	1969
Coal		
Electric power generation	854	1,249
Locomotive fuel	82	63
Paper and wood industry	780	756
Other industries	423	538
Gas and coke manufacture	161	185
Space heating	58	118
Total	2,358	2,909
Coke		
Metals reduction	732	797
Other industries	4	10
Space heating	65	184
Total	801	991

Imports of coal and coke from Poland were expected to increase in 1970, under a trade agreement signed in late 1969. Combined imports of these fuels from Poland, annually aggregating about 1.7 million tons, will rise to 2.1 million tons.

Nuclear Energy.—In mid-1969, an agreement was signed by Finland with the Soviet Union for construction of a nuclear powerplant at Loviisa, 50 miles east of Helsinki. The plant will have a generating capacity of 440 megawatts of electricity and is to be completed in 1975.

Petroleum.—The share provided by oil in Finland's total consumption of energy exceeded 50 percent for the first time in 1969. Imports of crude oil rose 21 percent, while consumption and refinery output rose 17 percent, as compared with 1968.

Imports of crude oil totaled approximately 7.1 million tons, of which 65 percent was supplied by the Soviet Union and the remainder by Iran. Imports from Iran than tripled, compared with 1968.

Refinery throughput was approximately equal to imports, with 4.4 million tons processed at Porvoo and 2.7 million tons at Naantali. Of the total crude oil processed,

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72 percent was from the U.S.S.R., 26 percent from Iran, and 2 percent was bitumen crude from Venezuela. Output of refined products by Neste Oy. was equivalent to 71.5 percent of national consumption. Total sales by the company in 1969 were 6.86 million tons, of which 55 percent went to marketing companies, 39 percent to consumers, and 6 percent was exported. Exports of refined products more than tripled, compared with 1968, while imports declined slightly.

New facilities under construction at Porvoo included a bitumen plant, scheduled for completion in 1970; an ethylene plant, scheduled for completion in 1971; and equipment for increasing production of middle distillates, to be installed by mid-1972. The ethylene plant, costing about $38 million, will produce raw materials for the petrochemicals industry. The petrochemicals company, Pekema Oy, was organized in 1969 and is owned 44 percent by Neste Oy.

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The Mineral Industry of France

By L. Nahai [1]

During 1969 the French economy maintained a high level of activity. The Gross national product (GNP) totaled $116 billion,[2] a 15-percent growth—8 percent in volume and 7 percent in price. However, the growth rate is somewhat exaggerated because of the substantial interruption of production in May and June 1968.

The main factors in increase of the GNP were demand for investment goods by industry and higher consumer spending. Overall increase in investment by the Government and private industry was 9.5 percent more in volume and 15.7 more in price. In the mineral industry, investments were principally in iron and steel, iron ore, potash, and coal.

The French franc was devalued by 12.5 percent on August 8, and this led to price increase for imported and domestic coal. However, the devaluation did not adversely affect the level of imports of the principal minerals and metals that France imports.

The value of crude mineral output in 1968, the last year for which data were available, was about $1,714 million,[3] equivalent to 1.5 percent of the GNP for the same year. Distribution of mineral output value by commodity group did not vary much from the previous year and was as follows in million dollars. Energy products (including uranium), 746; quarry products, 610; nonmetallic minerals other than quarry products, 192; and metallic minerals, 167. Solid fuels ranked first in value ($567 million), followed by sand and gravel ($234 million).[4]

As of December 31, 1968, personnel employed in the extractive industry, other than quarrying, totaled 183,487 a decline of 19,775 from the 1967 total. Declines in employment at coal mines accounted for 18,079 persons and at iron mines for 1,749. Employment in quarries in 1968 totaled 104,000 but this included labor employed in processing quarry products and fabricating concrete products. Labor in extraction alone may have been half of the above figure. Cement plants employed about 14,000 in 1969.

PRODUCTION

The level of production for the three principal metallic minerals (iron, lead, and zinc) that France produces was about the same as in 1968, but was generally higher for the main nonmetallic minerals (sulfur, potash, and fluorspar). Production data for quarry products for 1969 were not available, but in view of the high level of demand in the economy, the level of output may have been higher than in 1968. The output of the principal metals produced in the country (aluminum, lead, zinc, and iron and steel) increased; the highest increase for iron and steel. Among the fuels, the decline in coal production continued, but there was a significant increase in natural gas output and a 7 percent decline in domestic crude petroleum production.

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[2] Where necessary values have been converted from francs (Fr.) to U.S. dollars at the yearend rate of Fr. 1=US$0.180044, except as noted.

[3] Computed at the 1968 rate of exchange of Fr. 1=US$0.20255.

[4] Ministere du Développement Industriel et Scientifique. Bureau de Documentation minière. Statistiques de l'Industrie Minérale 1968. Ministry of Industrial and Scientific Development. Statistics of The Mineral Industry, 1968. Paris, France, February 1970, p. 7.

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Table 1.—France: Indexes of industrial production

(1962 = 100)

	1968	1969	Change, 1968-69 (percent)
All industrial production including construction and public works	135	150	11.1
All industrial production excluding construction and public works	134	151	12.7
Solid fuels	82	80	−2.4
Crude petroleum	113	105	−7.1
Natural gas	123	140	13.8
Petroleum processed	201	227	12.9
Electricity	143	160	11.9
Iron ore	83	84	1.2
Nonferrous ores	148	NA	NA
Iron and steel	119	132	10.9
Nonferrous metals	125	134	7.2
Construction materials and ceramics	152	171	12.5
Chemical industry	161	189	17.4
Building and public works	139	144	3.6

NA Not available.

Source: Institut National de la Statistique et des Études Economiques (Paris). Bulletin Mensuel de Statistique. March 1970, pp. 81-82; June 1970, pp. 11-12.

Table 2.—France: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Aluminum:			
Bauxite, gross weight—thousand tons	2,813	r 2,713	2,773
Alumina:			
Hydrates [1]	1,024,000	r 1,029,623	1,050,000
Calcined	r 919,788	951,862	991,241
Metal:			
Primary	361,214	r 365,700	371,700
Secondary	63,000	73,600	88,000
Semimanufactures	225,577	232,978	303,000
Castings	105,400	110,000	124,000
Antimony:			
Mine output, content of ore	167	---	---
Metal	1,091	r 1,331	2,129
Arsenic [2]	10,646	6,404	NA
Bismuth metal—kilograms	60,515	64,000	NA
Cadmium metal	499	550	NA
Cobalt metal	919	800	NA
Copper:			
Mine output, metal content	405	391	389
Metal:			
Blister (secondary)	7,700	NA	NA
Refined:			
Electrolytic	29,000	28,153	NA
From scrap	8,000	8,238	NA
Total	37,060	36,391	37,000
Gold:			
Mine output, metal content—troy ounces	62,694	58,450	54,946
Metal—do	69,800	r 55,000	48,000
Iron and steel:			
Iron ore and concentrate—thousand tons	49,220	55,238	55,425
Pig iron (including blast furnace alloys)—do	15,710	16,450	18,212
Of which spiegeleisen and high-carbon ferromanganese—do	320	374	427
Other ferroalloys—do	r 294	r 321	339
Steel, ingots and castings—do	19,655	20,409	22,511
Steel semimanufactures—do	14,847	15,711	17,487
Lead:			
Mine output, metal content	27,356	r 27,117	29,909
Metal:			
Primary	114,010	99,934	107,930
Secondary	14,606	22,900	19,820
Antimonial lead [3]	15,427	25,400	28,050
Total refined lead	144,043	r 148,234	155,800
Magnesium metal, including secondary	4,164	4,480	4,400
Manganese:			
Ore and concentrate, gross weight	2,304	2,602	NA
Nickel, metal content of pure nickel, ferronickel, and nickel oxide	11,717	r 9,273	9,483
Silicon	19,408	21,964	NA

See footnotes at end of table.

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Table 2.—France: Production of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS—Continued			
Silver:			
Mine output, metal content thousand troy ounces	2,163	2,166	2,396
Metal (content of final smelter products) do	4,716	r 5,722	4,135
Tin concentrate, metal content long tons	r 447	378	249
Tungsten concentrate, metal content	20	16	89
Uranium:			
Mine output, metal content	r 1,255	r 1,250	1,362
Concentrate, metal content	1,640	1,642	1,716
Zinc:			
Mine output, metal content	24,669	21,806	19,978
Metal, including secondary:			
Slab	185,688	207,414	253,500
Dust	5,150	r 6,198	7,500
NONMETALS			
Alabaster	1,640	1,550	NA
Asbestos	150	500	--------
Barite	101,997	90,932	95,000
Bromine, elemental	13,070	14,140	NA
Cement, all types thousand tons	24,418	25,393	27,543
Chalk do	3,839	3,835	NA
Clays:			
Bentonite	14,687	23,227	NA
Brick and tile clay thousand tons	9,934	10,272	NA
Ceramic and pottery clay	467,543	495,853	NA
Clay and marl for cement industry thousand tons	10,684	10,472	NA
Kaolin and kaolinitic clay	438,160	439,868	NA
Refractory clay thousand tons	781	723	NA
Diatomite	159,624	170,650	NA
Feldspar and pegmatites	179,843	177,483	NA
Fertilizer materials:			
Crude (natural):			
Phosphatic chalk	64,500	32,150	NA
Potash:			
Gross weight thousand tons	11,694	11,720	11,971
K_2O equivalent do	r 1,938	r 1,857	1,938
K_2O equivalent (marketable)	1,818	1,719	1,794
Manufactured:			
Nitrogenous, nitrogen content [4] thousand tons	r 1,296	1,386	1,405
Phosphatic: [5]			
Superphosphate, gross weight do	1,496	1,520	1,433
Thomas slag do	2,369	2,519	2,615
Potassic do	1,780	1,680	1,770
Mixed, gross weight [5] do	6,187	6,528	6,456
Fluorspar, marketable	244,418	261,000	300,000
Fly ash thousand tons	4,120	3,780	NA
Gypsum and anhydrite, crude do	5,192	5,315	NA
Lime:			
Hydraulic do	1,137	808	NA
High-grade do	2,921	3,193	NA
Mica	286	1,524	NA
Pigments, natural mineral, iron oxide	5,049	5,100	NA
Pumice	626	592	NA
Pozzolana and lapilli	723,385	726,202	NA
Pyrite, gross weight	85,380	82,000	85,000
Quartz and glass sand:			
Quartz	415,502	427,656	NA
Glass sand thousand tons	1,760	r 1,554	NA
Salt do	5,009	4,442	4,790
Stone, sand and gravel, n.e.s.:			
Building stone:			
Granite and similar rocks thousand tons	1,008	1,087	NA
Limestone do	2,886	2,563	NA
Marble do	516	501	NA
Other do	122	56	NA
Crushed limestone and granite	4,103	4,689	NA
Dolomite:			
For agriculture	136,660	169,732	NA
Crude for calcining	702,435	598,118	NA
Other	629,082	677,701	NA
Total	1,468,177	1,445,551	NA
Limestone, agricultural and industrial:			
For agriculture thousand tons	586	491	NA
For iron and steel industry do	4,355	4,660	NA
For lime and cement do	26,169	26,032	NA
For sugar mills do	466	652	NA
Total do	31,576	31,835	NA

See footnotes at end of table.

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Table 2.—France: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
NONMETALS—Continued			
Stone, sand and gravel, n.e.s.—Continued			
Road building, foundation and ballast (other than alluvial sand and gravel):			
Ballast thousand tons	69,580	73,046	NA
Foundation material do	6,110	5,592	NA
Ground rock for road filler do	108	93	NA
Paving block and curbing do	132	145	NA
Slate:			
Roof	124,018	121,268	108,000
Other	56,710	52,455	NA
Other stone:			
Beach pebble	53,541	195,432	NA
Lava	13,065	16,519	NA
Marl	242,537	205,613	NA
Mine fill thousand tons	12,107	11,882	NA
Millstones and grindstones	1,508	1,290	NA
Sand and gravel:			
Industrial sands:			
Foundry thousand tons	1,533	1,895	NA
Miscellaneous do	430	530	NA
Other sand and gravel (alluvial):			
By dredging do	80,686	84,329 1	190,000
By other winning methods do	71,973	77,543 1	
Sulfur, elemental do	1,665	1,635	1,732
Talc	217,353	246,085	247,000
MINERAL FUELS AND RELATED MATERIALS			
Bituminous asphaltic material	130,578	116,482	NA
Carbon black	118,760	118,150	137,000
Coal:			
Bituminous and anthracite thousand tons	47,625	41,911	40,584
Lignite do	2,931	3,221	2,950
Coke do	12,639	12,503	13,605
Coal briquets do	4,839	4,548	4,197
Gas natural:			
Gross production million cubic feet	302,010	304,764	345,340
Marketed do	196,455	200,657	229,756
Peat thousand tons	83	72	NA
Petroleum:			
Crude do	2,832	2,688	2,499
Refinery products do	r 70,443	r 75,711	84,345

p Preliminary. r Revised. NA Not available.
1 Hydrated and calcined alumina are successive stages of alumina production and are not to be added.
2 Arsenic content of final products.
3 Lead content.
4 From July 1 to June 30 of the succeeding year.
5 From May 1 to April 30 of the succeeding year.

TRADE

Details on foreign trade including total tonnage by commodities, principal sources and destinations appear in tables 3 and 4.

Table 3.—France: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	Total export		1968 destinations	
	1967	1968	EEC 1	Principal destinations
METALS				
Aluminum:				
Bauxite	158,255	157,322	93,026	West Germany 89,816; United Kingdom 59,801.
Oxide and hydroxide 2	204,299	234,063	32,938	Switzerland 107,953; Spain 49,814.
Metal, including alloys:				
Scrap	16,859	16,160	15,749	Italy 9,704; West Germany 5,516.
Unwrought	140,282	186,858	125,882	Belgium-Luxembourg 57,499; West Germany 44,465; mainland China 31,681.
Semimanufactures	67,403	69,726	31,874	West Germany 19,788; United States 14,688; Italy 5,600.
Antimony, metal, including scrap	53	143	17	United States 73.

See footnotes at end of table.

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Table 3.—France: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total export		1968 destinations	
	1967	1968	EEC [1]	Principal destinations
METALS—Continued				
Arsenic (anhydride)	12,715	13,250	1,980	United States 5,389; Japan 2,150; United Kingdom 1,863.
Beryllium	6	6	5	All to West Germany.
Bismuth, all forms	83	60	9	United Kingdom 52.
Cadmium	48	50	28	United Kingdom 19; Italy 11.
Chromium:				
Chromite	396	298	290	All to West Germany.
Oxide and hydroxide	592	776	216	Sweden 185; Netherlands 130.
Metal	229	213	119	West Germany 50; Sweden 42.
Cobalt	608	728	131	United States 331; United Kingdom 125.
Colombium—value, thousands	$48	$11	-------	NA.
Copper:				
Ore	172	-------	-------	
Matte	223	621	609	West Germany 451; Netherlands 121.
Metal and alloys:				
Scrap	43,479	33,030	29,704	West Germany 13,624; Belgium-Luxembourg 9,079; Italy 6,844.
Blister and other unrefined	12,453	12,687	12,667	Belgium-Luxembourg 8,598; West Germany 4,063.
Refined	14,020	12,677	11,475	Belgium-Luxembourg 5,081; Netherlands 3,092; West Germany 2,969.
Semimanufactures	29,510	32,966	18,557	United States 8,508; West Germany 8,184; Netherlands 3,719.
Gallium [3]—value, thousands	$223	$191	-------	Switzerland $188.
Germanium, all forms	1	2	2	All to Belgium-Luxembourg.
Gold: [4]				
Metal, including alloys—troy ounces	98,060	91,404	48,387	Netherlands 36,894; Switzerland 11,188.
Ashes and sweepings—do	2,765	1,736	198	Switzerland 1,222.
Other metal (temporary imports and exports)—troy ounces	64,178	657,835	153,841	Muscat and Oman 234,925; Netherlands 140,016; Switzerland 99,667.
Iron and steel:				
Iron ore—thousand tons	17,537	18,271	18,198	Belgium-Luxembourg 13,691; West Germany 4,507.
Pyrite cinder—do	227	210	210	West Germany 120; Belgium-Luxembourg 89.
Metal:				
Scrap—do	2,191	2,192	2,179	Italy 1,916; Belgium-Luxembourg 152.
Pig iron, including spiegeleisen [5]—do	95	54	52	Belgium-Luxembourg 19; West Germany 12.
Ferroalloys—do	287	290	190	Italy 69; United States 66; West Germany 65.
Shot and powder	16	18	13	West Germany 6; Italy 6.
Steel:				
Primary forms, including coils—do	960	739	513	Italy 212; Belgium-Luxembourg 134; West Germany 110; Switzerland 86.
Semimanufactures:				
Bars, rods, wire rods, and sections—do	2,251	2,678	1,026	United States 650; West Germany 570; Belgium-Luxembourg 226.
Plates, sheets, and universals—do	2,261	2,386	1,054	West Germany 705; United States 231; Italy 184; Switzerland 136.
Hoop and strip—do	202	241	148	West Germany 69; Belgium-Luxembourg 27; Switzerland 25; Netherlands 24.
Rails and accessories—do	138	133	52	Italy 39; Iran 21; Denmark 9.
Wire—do	102	105	19	United States 35; West Germany 10; Morocco 6.
Tubes, pipes, and fittings—do	645	693	139	Algeria 102; Netherlands 90; Iran 62; United States 50.
Castings and forgings, rough—do	4	8	4	Mainly to Belgium-Luxembourg.

See footnotes at end of table.

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Table 3.—France: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total export		1968 destinations	
	1967	1968	EEC [1]	Principal destinations
METALS—Continued				
Lead:				
Ore	3,898	3,611	3,466	Belgium-Luxembourg 2,025; West Germany 1,376.
Oxides	7,779	8,199	2,729	Netherlands 1,730: United States 1,713; Czechoslovakia 1,173.
Metal, including alloys:				
Scrap	9,615	10,535	10,492	Italy 8,011; West Germany 2,079.
Pig, including alloys	18,025	16,773	1,553	United States 4,902; Switzerland 4,224; Greece 3,004.
Semimanufactures, including alloys	902	1,136	141	Syrian Arab Republic 125; Yugoslavia 149; Italy 103.
Magnesium, all forms	242	482	227	West Germany 183; Greece 90.
Manganese:				
Ore	1,136	504	328	Netherlands 180; Italy 124; Spain 102.
Oxide	406	720	332	Austria 289; Netherlands 230.
Metal, all forms	3,322	4,674	2,928	Italy 1,572; West Germany 1,295.
Mercury 76-pound flasks	261	290	232	Belgium-Luxembourg 174.
Molybdenum:				
Ore	5	54	54	Belgium-Luxembourg 33.
Oxide	29	23	20	Italy 13; West Germany 6.
Metal, all forms	13	15	12	West Germany 4; Italy 4.
Nickel:				
Matte, speiss, etc	256	167	74	Sweden 62; Italy 32.
Oxide and hydroxide	39	152	82	Italy 31; Japan 29; West Germany 23; Spain 23.
Metal including alloys:				
Scrap	2,304	1,850	1,391	West Germany 487; Belgium-Luxembourg 452; Netherlands 431.
Ingots	8,542	5,824	3,083	West Germany 1,704; Italy 1,027; mainland China 1,002.
Semimanufactures, including anodes	2,617	2,472	1,205	West Germany 706; Spain 573; Belgium-Luxembourg 174.
Platinum and platinum-group: [4]				
Ashes and sweepings troy ounces	527,625	2,446,218	2,385,100	West Germany 1,579,389; Italy 805,761.
Metal, including alloys do	84,042	113,813	58,611	West Germany 26,106; Netherlands 28,888; United States 20,432.
Selenium	1	1	1	NA.
Silver: [4]				
Metal, including alloys thousand troy ounces	2,314	11,011	3,129	United Kingdom 3,772; Switzerland 3,246; Netherlands 2,337.
Ashes and sweepings do	844	786	581	All to West Germany.
Sodium metal	2,522	2,494	2,493	Italy 2,272.
Tantalum, all forms value, thousands	$113	$118	$89	Italy $54; West Germany. $28.
Thorium oxide	9	1	------	NA.
Tin:				
Ore long tons	524	560	------	Spain 555.
Oxide do	43	43	42	All to West Germany.
Metal, including alloys:				
Scrap do	18	18	7	United Kingdom 10.
Ingots do	157	290	188	Italy 110; Netherlands 77.
Semimanufactures do	54	123	44	Belgium-Luxembourg 27.
Titanium:				
Ore	25	156	------	Algeria 124.
Oxide	13,807	10,170	2,937	United States 3,442; Netherlands 1,127; Italy 787.
Metal, all forms	32	37	25	Italy 13; West Germany 10; United Kingdom 8.
Tungsten:				
Ore	34	1	1	All to West Germany.
Trioxide	87	144	34	Austria 109.
Metal, all forms	234	336	164	West Germany 145; United Kingdom 132.
Zinc:				
Ore	219	27,231	283	United Kingdom 14,417; Rumania 9,977.
Matte	1,069	1,055	1,055	Belgium-Luxembourg 845; Italy 144.
Oxide	7,496	9,906	1,604	Mainland China 2,274; Turkey 1,355; U.S.S.R. 1,050.
Metal, including alloys:				
Scrap	2,228	2,410	2,388	Italy 2,267.
Dust, (blue powder)	1,479	1,295	227	Norway 800; Switzerland 198.
Slab and ingot	12,130	20,610	15,606	West Germany 11,410; Italy 3,706.
Semimanufactures	3,532	3,213	1,916	West Germany 1,882; Portugal 400.

See footnotes at end of table.

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Table 3.—France: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total export		1968 destinations	
	1967	1968	EEC [1]	Principal destinations
METALS—Continued				
Zirconium:				
Ore	83	160	104	West Germany 70.
Oxide	88	51	37	Netherlands 15; West Germany 11.
Metal, including nuclear grade	268	374	29	United States 186; Sweden 89.
Other:				
Ore and concentrate	119	364	68	United Kingdom 254.
Ash and residues from nonferrous metals:				
Aluminum	4,682	4,690	4,070	Italy 3,274; West Germany 698.
Copper	5,039	5,584	5,461	West Germany 3,105; Belgium-Luxembourg 2,356.
Lead	10,318	10,730	10,730	Belgium-Luxembourg 9,928
Nickel	952	662	633	Italy 427; West Germany 197.
Zinc	9,868	8,868	8,868	Belgium-Luxembourg 7,091.
Other	38,223	44,568	28,462	Belgium-Luxembourg 15,426; Sweden 14,935; West Germany 8,504.
Slag and ash, n.e.s.	73,562	185,332	181,860	Belgium-Luxembourg 150,513; West Germany 29,927.
Metals, including alloys, all forms [6]	135	153	98	West Germany 61; Belgium-Luxembourg 32.
NONMETALS				
Abrasives, natural:				
Pumice, emery and other	495	570	396	West Germany 309; Tunisia 58.
Dust and powder of precious and semiprecious stones value, thousands	$409	$382	$250	NA.
Grinding and polishing wheels	2,200	2,398	1,319	West Germany 424; Italy 399.
Asbestos, crude	1,087	1,030	518	Belgium-Luxembourg 466; Algeria 418.
Asbestos cement products	29,036	23,680	8,614	West Germany 5,362; United Kingdom 3,279.
Barite including witherite	18,154	15,063	7,100	Italy 2,647; Belgium-Luxembourg 2,369; Gabon 2,095.
Borates, natural	534	4,108	3,392	Italy 2,090; West Germany 1,237.
Bromine	1,306	1,693	176	Switzerland 933; United Kingdom 536.
Cement thousand tons	928	868	236	West Germany 175; Ivory Coast 108; Spanish North Africa 91.
Chalk	307,501	287,409	247,723	West Germany 127,426; Belgium-Luxembourg 65,320; Netherlands 46,577.
Clays and clay products:				
Crude:				
Kaolin	53,631	60,154	52,120	West Germany 42,634; Switzerland 4,591.
Bentonite	2,886	3,523	1,501	Belgium-Luxembourg 1,117; United Kingdom 761.
Refractory	316,340	339,477	313,671	Italy 183,656; West Germany 90,340; Belgium-Luxembourg 36,660.
Other	60,484	65,469	55,281	Italy 25,561; Belgium-Luxembourg 24,278.
Clay and refractory construction materials (bricks, tile, etc.)	162,854	145,352	165,351	West Germany 33,636; Belgium-Luxembourg 27,973.
Corundum:				
Natural including emery (included in abrasives above)	44	109	51	NA.
Artificial	12,355	11,587	5,183	Italy 2,521; Belgium-Luxembourg 1,701; Switzerland 1,649.
Cryolite and chiolite, natural	104	1,598	285	Cameroon 875; Greece 410.
Diamond:				
Industrial, excluding powder value, thousands	$1,322	$1,459	$1,109	West Germany $761; Netherlands $179; India $134.
Gem, unset do.	$3,998	$5,818	$1,498	Switzerland $1,701; Republic of South Africa $1,334; Netherlands $867.
Diatomite	17,136	17,684	14,494	West Germany 11,918; Italy 1,026.
Feldspar	19,924	21,653	15,845	Belgium-Luxembourg 7,519; West Germany 7,421; Switzerland 4,531.
Fertilizer materials:				
Crude:				
Nitrogenous (natural sodium nitrates)	164	870	820	Mostly to Belgium-Luxembourg.
Phosphate rock	3,052	824	617	West Germany 216; Switzerland 97.
Potassic salts	69,754	56,744	52,635	Belgium-Luxembourg 29,019; Netherlands 23,616.
Organic	32,065	37,765	8,651	Switzerland 16,495; Cuba 10,000; West Germany 4,058.

See footnotes at end of table.

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Table 3.—France: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total export		1968 destinations	
	1967	1968	EEC [1]	Principal destinations
NONMETALS—Continued				
Fertilizer materials—Continued				
Manufactured:				
Ammonia, anhydrous thousand tons	14	7	2	Spain 2; Belgium-Luxembourg 2; Senegal 2.
Nitrogenous do	1,056	592	94	Mainland China 139; Belgium-Luxembourg 84; Algeria 45.
Phosphatic:				
Basic slag do	350	312	32	Austria 149; Switzerland 126; Italy 32.
Other do	80	51	9	Cuba 14; Spain 8; Switzerland 6; Italy 5.
Potassic do	1,260	1,146	317	Belgium-Luxembourg 141; United Kingdom 136; Netherlands 90; United States 87.
Flint (pebbles)	87,233	103,144	44,324	United Kingdom 31,463; West Germany 18,544.
Fluorspar	109,104	117,261	105,501	West Germany 71,205; Italy 14,943; Belgium-Luxembourg 12,015.
Graphite	2,633	1,697	867	West Germany 360; Belgium-Luxembourg 312; United Kingdom 227.
Gypsum and anhydrite, including plasters	837,413	863,514	517,982	Belgium-Luxembourg 400,634; Sweden 169,408; Netherlands 81,265.
Iodine	115	42	13	West Germany 10; Switzerland 10.
Lime	253,422	287,231	251,800	West Germany 140,857; Belgium-Luxembourg 110,796.
Magnesite, including calcined	334	2,557	2,341	West Germany 2,236.
Mica	903	1,502	1,225	West Germany 680; Italy 60.
Pigments, mineral including iron oxide	4,129	3,150	831	United Kingdom 352; Netherlands 346; Morocco 345.
Pozzolan, santorin, etc	1,279	1,781	65	NA.
Precious and semiprecious stones, except diamond [7] value, thousands	$11,145	$10,778	$1,396	Switzerland $5,466; United States $2,004; Italy $906.
Pyrite, gross weight	9,755	3,145	3,145	All to West Germany.
Salt	93,821	83,505	45,244	Belgium-Luxembourg 15,313; Netherlands 14,399; West Germany 14,376.
Sodium and potassium, compounds n.e.s:				
Caustic soda	232,171	198,436	25,967	Guinea 55,567; Brazil 26,411; U.S.S.R. 13,105.
Caustic potash	10,917	9,563	4,061	Netherlands 3,411; United Kingdom 1,191; Switzerland 665.
Stone, sand and gravel: [8]				
Building stone:				
Crude and partly worked, n.e.s	104,261	92,810	77,506	Belgium-Luxembourg 54,568; West Germany 14,817; Switzerland 10,723.
Worked:				
Not specified	6,193	7,401	5,791	West Germany 2,477; Belgium-Luxembourg 1,607; Netherlands 781.
Slate, including crude	19,698	18,569	18,011	Netherlands 9,369; Belgium-Luxembourg 5,771.
Dolomite, chiefly refractory grade	58,127	76,826	66,408	Belgium-Luxembourg 44,845; West Germany 16,550.
Gravel and crushed stone thousand tons	8,750	10,123	8,637	West Germany 6,568; Switzerland 1,480; Belgium-Luxembourg 1,279.
Limestone (except dimension)	135,861	117,144	72,441	Belgium-Luxembourg 70,318; Switzerland 44,691.
Quartz and quartzite	256	411	154	Italy 127; Switzerland 37.
Sand, excluding metal bearing thousand tons	1,876	2,208	1,657	West Germany 737; Belgium-Luxembourg 600; Switzerland 544.
Sulfur, elemental do	1,035	1,060	264	United Kingdom 295; Netherlands 121; Greece 97; West Germany 84.
Talc and steatite	44,991	44,376	15,602	West Germany 9,036; United Kingdom 7,316; United States 5,015; Switzerland 4,740.

See footnotes at end of table.

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Table 3.—France: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total export		1968 destinations	
	1967	1968	EEC [1]	Principal destinations
NONMETALS—CONTINUED				
Other:				
Nonmetals, n.e.s.	180,082	145,062	24,708	Switzerland 118,780; West Germany 20,797.
Slag, dross and similar waste, not metal bearing, from iron and steel manufactures thousand tons	1,058	947	901	West Germany 840; Belgium-Luxembourg 44.
Oxide and hydroxide of magnesium strontium, and barium	8,108	6,825	1,147	U.S.S.R. 4,450; West Germany 724.
Flourine	25	1,349	1,349	Mostly to West Germany.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	17,289	21,243	1,811	United Kingdom 19,315.
Carbon black	44,185	43,623	17,385	West Germany 6,704; Spain 6,566; Italy 5,614.
Coal and briquets:				
Bituminous	707,118	860,229	807,636	West Germany 376,677; Belgium-Luxembourg 303,435; Netherlands 102,213.
Briquets of bituminous coal	15,635	14,149	7,768	Italy 7,722; Switzerland 5,546.
Lignite	83,825	28,985	-------	Spain 28,970.
Coke	117,864	185,322	125,411	Belgium-Luxembourg 64,827; West Germany 26,260; Italy 23,177.
Gas, including liquid petroleum gas	488,535	498,667	38,402	Spain 277,692; Portugal 113,313.
Hydrogen, helium and rare gases	5,120	2,851	2,559	West Germany 1,081; Belgium-Luxembourg 1,007.
Peat including briquets	937	1,191	1,165	Mainly to West Germany.
Petroleum refinery products:				
Gasoline thousand tons	2,740	2,886	863	United Kingdom 1,477; West Germany 536; Switzerland 280.
Kerosine and jet fuel do	553	441	90	Switzerland 198; West Germany 58; Spain 56.
Distillate fuel oil do	2,990	2,649	1,464	West Germany 1,170; Switzerland 783.
Residual fuel oil do	4,977	4,229	1,740	United Kingdom 1,482; West Germany 1,002.
Lubricants do	308	283	84	United Kingdom 62; Algeria 36; Belgium-Luxembourg 27.
Other: Bitumen, petroleum coke, and other residues thousand tons	467	434	237	West Germany 173; Switzerland 86.
Chemical derivatives of coal, petroleum or gas	102,147	62,769	34,258	Belgium-Luxembourg 14,287; Switzerland 9,559; Netherlands 7,758.

NA Not available.
[1] Belgium, West Germany, Italy, Luxembourg, and the Netherlands.
[2] Excludes artificial corundum.
[3] Including indium and thallium.
[4] Calculated from quantities reported in kilograms.
[5] Including cast iron and shot, grit, powder, and sponge of iron or steel.
[6] Alkali, alkaline earth, and rare-earth metals except sodium.
[7] Including synthetic and reconstituted stone but not including diamond.
[8] Not including slate, flint, or industrial limestone.

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Table 4.—France: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	Total import		1968 sources	
	1967	1968	EEC [1]	Principal sources
METALS				
Aluminum:				
Bauxite	226,379	334,846	806	Australia 211,598; Greece 61,815; Guyana 36,902.
Oxide and hydroxide [2]	3,266	31,215	2,210	Jamaica 15,894; United States 6,861; Guinea 5,460.
Metal, including alloys:				
Scrap	5,954	5,522	4,760	Belgium-Luxembourg 3,464.
Unwrought	98,774	97,861	9,929	Cameroon 29,963; Greece 25,589; United States 12,744.
Semimanufactures	38,221	59,400	53,243	West Germany 31,335; Belgium-Luxembourg 15,442.
Antimony:				
Ore and concentrate	1,261	2,430	-------	Bolivia 807; Republic of South Africa 716; Morocco 705.
Metal, all forms	2,212	1,232	886	Mainland China 663; Belgium-Luxembourg 371.
Arsenic, anhydride and acid	6	21	-------	NA.
Beryllium:				
Ore	2	36	-------	Argentina 22.
Metal, all forms value, thousands	$97	$138	-------	United States $94; United Kingdom $43.
Bismuth	806	943	87	Peru 340; United Kingdom 170; Japan 168.
Cadmium	505	348	162	Belgium-Luxembourg 126; Japan 56; Congo (Kinshasa) 55.
Chromium:				
Ore	248,857	263,119	867	U.S.S.R. 97,076; Turkey 74,748; Iran 49,035.
Oxide and hydroxide	1,871	2,041	1,433	West Germany 1,313; United Kingdom 504.
Metal	69	40	1	United States 18; United Kingdom 14.
Cobalt:				
Ore	11,924	11,600	-------	Morocco 11,527.
Oxide and hydroxide	133	114	113	Belgium-Luxembourg 110.
Metal, all forms	398	273	206	Belgium-Luxembourg 196.
Columbium:				
Ore (including tantalum ore)	382	560	-------	United States 299; Canada 260.
Metal, all forms value, thousands	$26	$98	$14	NA.
Copper:				
Matte	1,209	332	175	Belgium-Luxembourg 175; United States 127.
Metal, including alloys:				
Scrap	11,495	14,809	7,915	West Germany 3,981; Belgium-Luxembourg 2,951; Switzerland 2,106.
Blister and other unrefined	11,609	16,416	8,752	Belgium-Luxembourg 8,364; Congo (Kinshasa) 5,877.
Refined	236,966	259,946	97,736	Belgium-Luxembourg 82,149; Zambia 56,835; Chile 33,287; Congo (Kinshasa) 25,716.
Semimanufactures	23,642	28,140	19,590	West Germany 8,366; Belgium-Luxembourg 7,967.
Germanium, gallium, etc. value, thousands	$323	$390	$298	Belgium-Luxembourg $214; Netherlands $51.
Gold: [3]				
Ashes and sweeping troy ounces	700,499	108,574	22,313	All from Netherlands.
Metal, including alloys ---do---	43,082	107,383	86,678	West Germany 71,278.
Metal, other (temporary imports and reexports) ---do---	908,891	1,325,734	53,563	United Kingdom 1,107,656.
Iron and Steel:				
Ore and concentrate, except roasted pyrite thousand tons	4,845	5,017	2	Mauritania 1,346; Brazil 1,313; Liberia 1,174.
Roasted pyrite ---do---	46	34	16	Spain 18; Italy 16.
Metal:				
Scrap ---do---	464	373	279	Belgium-Luxembourg 204; Netherlands 38; West Germany 35.
Pig iron, spiegeleisen and other [4] thousand tons	174	245	194	West Germany 95; Netherlands 54; Belgium-Luxembourg 44.
Ferroalloys ---do---	73	80	22	New Caledonia 50; Belgium-Luxembourg 11.
Steel, primary forms ---do---	1,207	1,278	1,217	West Germany 574; Belgium-Luxembourg 525.

See footnotes at end of table.

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Table 4.—France: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total import		1968 sources	
	1967	1968	EEC [1]	Principal sources
METALS—Continued				
Iron and steel—Continued				
Semimanufactures:				
Bars, rods, sections [2] thousand tons	1,511	1,443	1,402	West Germany 762; Belgium-Luxembourg 542.
Plates, sheets, and universals ....do....	1,768	1,731	1,602	Belgium-Luxembourg 891; West Germany 525.
Hoop and strip ....do....	261	269	266	Belgium-Luxembourg 169; West Germany 89.
Rails and accessories ....do....	43	54	13	United Kingdom 40; Belgium-Luxembourg 10.
Wire ....do....	77	76	70	West Germany 35; Belgium-Luxembourg 10.
Tubes, pipes, and fittings ....do....	245	268	231	West Germany 134; Belgium-Luxembourg 33.
Castings and forgings, rough	3,043	4,841	4,071	West Germany 2,244; Belgium-Luxembourg 1,754.
Lead:				
Ore and concentrate	128,458	128,384	-------	Morocco 36,754; Ireland 28,799; Australia 17,112.
Oxides	1,458	2,011	1,798	Belgium-Luxembourg 981; West Germany 575.
Metal, including alloys:				
Scrap	4,514	3,283	2,723	Belgium-Luxembourg 2,082; West Germany 633.
Unwrought	39,605	47,042	16,591	Morocco 22,003; Belgium-Luxembourg 9,319; West Germany 7,125.
Semimanufactures	749	734	665	Belgium-Luxembourg 412; West Germany 239.
Magnesium, including alloys:				
Scrap	158	18	10	NA.
Unwrought	986	1,299	342	Canada 424; Italy 340; United Kingdom 164.
Semimanufactures	194	102	7	United Kingdom 71.
Manganese:				
Ore and concentrate	689,827	889,959	553	Republic of South Africa 346,770; Gabon 247,071; U.S.S.R. 90,841.
Oxide	2,316	3,093	2,421	Belgium-Luxembourg 2,225; Japan 670.
Metal, all forms	676	342	13	Republic of South Africa 267.
Mercury, all forms ..76-pound flasks..	9,718	9,167	1,566	Spain 3,104; Mexico 1,682.
Molybdenum:				
Ore and concentrate	5,436	4,517	644	Canada 1,968; United States 1,035.
Oxide	8	3	3	NA.
Metal, all forms	82	84	61	West Germany 35; Netherlands 25.
Nickel:				
Matte	18,614	13,382	18	New Caledonia 7,744; Cuba 4,481.
Oxide and hydroxide	98	124	30	Canada 57; Cuba 27.
Metal, including alloys:				
Scrap	382	238	162	Belgium-Luxembourg 85; Netherlands 58.
Unwrought	8,852	9,849	37	United Kingdom 4,430; Canada 3,631.
Semimanufactures (including anodes)	2,847	2,624	855	United Kingdom 1,153; West Germany 805.
Platinum and platinum group:				
Ashes and sweepings troy ounces..	37,423	21,252	16,397	Netherlands 15,079.
Metals ....do....	160,914	215,088	69,285	U.S.S.R. 63,401; West Germany 35,527; United Kingdom 35,076.
Selenium	28	27	7	United States 8; Sweden 6; West Germany 5.
Silver: [3]				
Ashes and sweeping thousand troy ounces..	433	1,247	763	Netherlands 717; Switzerland 340.
Metal, all forms ....do....	20,871	31,443	5,723	United States 9,677; United Kingdom 7,395; Muscat and Oman 4,726.
Tantalum, all forms	11	8	4	Belgium-Luxembourg 3; United States 3.
Thorium:				
Ore (monazite)	1,133	70	-------	United States 45; Congo (Kinshasa) 25.
Metal ....value, thousands..	-------	$7	$3	NA.

See footnotes at end of table.

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Table 4.—France: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total import		1968 sources	
	1967	1968	EEC [1]	Principal sources
METALS—Continued				
Tin:				
Oxide—long tons	59	85	83	Belgium-Luxembourg 49; West Germany 34.
Metal, including alloys:				
Scrap—do	31	111	64	Italy 45; Switzerland 34.
Ingots—do	10,216	9,639	3,815	Belgium-Luxembourg 1,963; Netherlands 1,705; mainland China 1,264.
Semimanufactures—do	38	57	25	United Kingdom 25.
Titanium:				
Ore	99,257	135,066	3	Australia 128,758.
Oxide	14,328	17,885	16,545	West Germany 10,180; Belgium-Luxembourg 3,784.
Metal, all forms	495	490	59	Japan 184; U.S.S.R. 113.
Tungsten:				
Ore	1,972	1,585	25	South Korea 672; mainland China 321; Brazil 300.
Trioxide	8	76	76	Mainly from West Germany.
Metal, all forms	78	55	44	Netherlands 15; West Germany 14; Belgium-Luxembourg 12.
Uranium:				
Ore	1,945	2,130	-------	Gabon 1,237; Portugal 663.
Metal, including alloys—kilograms	NA	1,000	-------	United Kingdom 1,000.
Zinc:				
Ore and concentrate	332,140	361,384	71,236	Canada 76,323; Morocco 43,900; Ireland 41,364; Peru 41,272.
Oxide	1,438	2,313	1,562	West Germany 981; East Germany 640.
Metal, including alloys:				
Scrap	15,108	19,193	18,256	Netherlands 9,287; Belgium-Luxembourg 7,103.
Blue powder	4,153	3,048	2,882	Mainly from Belgium-Luxembourg.
Unwrought	34,048	31,080	21,588	Belgium-Luxembourg 13,090; West Germany 5,808.
Semimanufactures	4,947	4,750	4,564	Belgium-Luxembourg 2,555; West Germany 1,995.
Zirconium:				
Ore	17,901	23,828	6	Australia 23,731.
Oxide	785	981	9	United States 867.
Metal	43	1	-------	NA.
Other:				
Ores and concentrates	12,083	15,375	77	Republic of South Africa 4,143; Australia 3,271; Turkey 2,748.
Ashes and residues containing nonferrous metals:				
Aluminum	2,195	3,121	3,071	West Germany 1,555; Italy 1,333.
Copper	798	156	104	All from Belgium-Luxembourg.
Lead	807	370	55	Canada 279.
Nickel	6	29	9	NA.
Zinc	13,105	13,736	12,064	West Germany 7,659; Belgium-Luxembourg 3,599.
Other	846	16,116	3,318	Canada 9,503; Belgium-Luxembourg 2,113.
Metals, including alloys, all forms	76,616	321	319	Mainly from West Germany.
NONMETALS				
Abrasives:				
Emery, natural corundum, other	1,386	2,950	-------	All from Greece.
Pumice	33,700	28,173	27,722	Italy 21,566.
Dust of powder of precious and semiprecious stones—value, thousands	$3,393	$3,578	$814	United States $1,439; United Kingdom $1,030; Netherlands $572.
Grinding and polishing wheels	4,348	4,443	3,039	Italy 978; West Germany 960; Belgium-Luxembourg 950.
Asbestos	126,743	128,614	9,367	Canada 65,859; U.S.S.R. 37,764.
Barite and witherite	88,688	80,537	70,814	West Germany 70,523.
Boron materials:				
Crude natural borates	82,910	97,659	727	Turkey 52,473; United States 44,347.
Oxide and acid	606	915	339	United States 547; Italy 307.
Bromine—value, thousands	$16	$26	$11	Israel $15.
Cement	42,755	100,118	64,046	Switzerland 35,171; West Germany 28,382; Italy 27,069.
Chalk	7,442	4,434	4,224	Mainly from Belgium-Luxembourg.

See footnotes at end of table.

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Table 4.—France: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	Total import		1968 sources	
	1967	1968	EEC [1]	Principal sources
NONMETALS—Continued				
Clays and clay products:				
Crude:				
Kaolin, including calcined	228,659	256,417	8,509	United Kingdom 218,189.
Bentonite	127,857	107,233	33,712	Greece 47,682; Italy 26,406; United States 8,653.
Refractory clays	148,708	166,002	139,435	West Germany 119,279; United Kingdom 21,471.
Clay and refractory construction materials (bricks, etc.)	34,698	465,267	397,963	West Germany 216,329; Italy 99,353; Belgium-Luxembourg 78,471.
Cryolite and chiolite, natural	1,431	1,630	20	Denmark 1,610.
Diamond:				
Industrial, except dust value, thousands	$5,146	$5,833	$1,672	Ireland $2,979; Belgium-Luxembourg $1,002; United Kingdom $722.
Gem, unset ...do	$19,593	$36,097	$18,280	Belgium-Luxembourg $15,848; Switzerland $6,039; Israel $4,941.
Diatomite	7,106	7,009	1,989	United States 2,535; West Germany 1,693; Algeria 1,144.
Feldspar	11,946	15,825	4,974	Norway 6,053; West Germany 3,609; Finland 2,059.
Fertilizer materials:				
Crude:				
Nitrogenous (natural sodium nitrate)	22,962	24,888	20	Chile 24,868.
Phosphate rock thousand tons	3,110	3,397	6	Morocco 1,723; Tunisia 640; Togo 575.
Manufactured:				
Ammonia, anhydrous	61,638	150,226	149,765	Belgium-Luxembourg 126,999.
Nitrogenous	139,108	213,104	174,296	Belgium-Luxembourg 142,471; Rumania 28,746.
Potassic	95,668	270,964	170,519	West Germany 106,811; Spain 62,105; Belgium-Luxembourg 59,696.
Phosphatic:				
Basic slag	744,537	840,764	840,764	Belgium-Luxembourg 731,333; West Germany 109,431.
Other	324,135	361,274	258,918	Netherlands 150,422; Belgium-Luxembourg 107,256; United States 48,320.
Flint (pebbles)	178,732	631,220	18,816	NA.
Fluorspar	3,476	365	365	West Germany 300.
Graphite	4,882	4,776	1,500	Malagasy Republic 2,818; Italy 1,026.
Gypsum and plaster	21,348	20,969	20,819	West Germany 16,494.
Iodine, crude	362	285	------	Japan 200; Chile 81.
Lime	118,454	126,241	125,049	Belgium-Luxembourg 92,123.
Lithium and strontium minerals	2,570	2,655	2,013	Mainly from Netherlands.
Magnesite, including calcined	39,620	42,640	1,757	Austria 20,803.
Mica	3,652	5,173	6	India 2,362.
Pigments:				
Earth pigments, including iron oxide	13,888	502	127	Spain 205.
Earths, other (pozzolanic, santorin, etc.)	405	82	72	NA.
Precious and semiprecious stones [6] value, thousands	$9,456	$10,759	$478	India $5,437; Switzerland $835.
Pyrite	315,816	315,656	499	Cyprus 152,033; Spain 118,166.
Salt	51,460	70,889	31,958	Algeria 38,480; Netherlands 19,670.
Sodium and potassium salts, n.e.s.:				
Caustic soda	33,686	47,379	46,377	Belgium-Luxembourg 16,064; Italy 13,114.
Caustic potash and peroxides of potassium and sodium	110	178	108	Sweden 68; West Germany 75.
Stone, sand and gravel: [7]				
Dimension stone:				
Crude and partly worked:				
Slate	2,089	2,891	2,401	West Germany 1,087; Italy 822.
Other	190,387	173,253	79,902	Italy 73,695; Republic of South Africa 46,814.
Worked:				
Slate	26,977	43,574	1,715	Spain 29,122; United Kingdom 6,063.
Other	79,308	79,783	66,706	Italy 62,732.
Dolomite, chiefly refractory grade	172,907	181,459	173,741	Belgium-Luxembourg 159,956.
Gravel and crushed stone thousand tons	3,288	3,458	3,451	Belgium-Luxembourg 3,262.
Limestone	145,054	170,977	170,977	Belgium-Luxembourg 165,918.
Quartz and quartzite	21,369	22,613	21,744	Belgium-Luxembourg 10,972; Italy 7,079.
Sand, excluding metal bearing thousand tons	1,643	1,609	1,481	Netherlands 650; Belgium-Luxembourg 593; West Germany 220.

See footnotes at end of table.

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Table 4.—France: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total import		1968 sources	
	1967	1968	EEC [1]	Principal sources
NONMETALS—Continued				
Sulfur, elemental, all grades	235,100	335,627	1,002	Mexico 228,717; Poland 81,304.
Talc and steatite	8,659	9,655	6,646	Italy 4,427; Belgium-Luxembourg 2,072.
Other nonmetals, n.e.s.	528,743	562,383	25,116	Switzerland 495,239.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	2,317	2,794	888	United States 1,480; Trinidad and Tobago 363.
Carbon black	47,754	52,655	32,113	Netherlands 20,483; United States 15,347; West Germany 7,178.
Coal and briquets:				
Coal—thousand tons	11,445	11,565	7,496	West Germany 6,308; United States 1,573; U.S.S.R. 1,224.
Coal briquets—do	324	334	311	Netherlands 188; Belgium-Luxembourg 76; U.S.S.R. 23.
Lignite and lignite briquets do	357	346	346	Mainly from West Germany.
Coke—do	3,326	3,520	3,519	West Germany 3,071.
Gas, hydrocarbon:				
Natural	627,816	1,512,130	1,148,842	Netherlands 1,054,539; Algeria 310,240.
Manufactured	118,068	69,317	67,420	West Germany 48,518; Belgium-Luxembourg 16,975.
Hydrogen and rare gases	692	2,746	2,645	West Germany 2,565.
Peat, including briquets thousand tons	30	34	32	West Germany 22; Netherlands 9.
Petroleum:				
Crude—do	72,348	77,176	-------	Algeria 24,429; Iraq 15,160; Libya 10,818.
Refinery products:				
Gasoline—do	568	791	529	Italy 334; Rumania 142; Belgium-Luxembourg 69.
Kerosine—do	31	80	11	United Kingdom 17; Netherlands 4; Belgium-Luxembourg 4.
Distillate fuel oil—do	2,675	2,920	1,351	Italy 1,070; U.S.S.R. 766; Rumania 670.
Residual fuel oil—do	1,118	932	488	Italy 246; Rumania 227; U.S.S.R. 205.
Lubricants—do	35	48	27	Netherlands 14; Curacao 8; United States 7; Italy 7.
Other (vaseline, waxes, petroleum coke, bitumens, etc.)—do	494	180	41	United States 110; West Germany 29; Venezuela 24.
Mineral tar and crude chemicals derived from coal, petroleum or gas	310,270	223,893	104,517	United States 64,651; West Germany 37,665; United Kingdom 34,175.

NA Not available.
[1] Belgium, West Germany, Italy, Luxembourg, and the Netherlands.
[2] Excludes artificial corundum.
[3] Calculated from quantities reported in kilograms.
[4] Includes cast iron and sponge, powder, etc., of iron and steel.
[5] Including wire rod.
[6] Including synthetic and reconstituted stone but not including diamond.
[7] Excludes flint and industrial limestone.

COMMODITY REVIEW

METALS

Bauxite and Aluminum.—Bauxite consumption in 1969 totaled 2,970,000 tons compared with 2,864,000 tons in 1968. In 1968, 2,595,000 tons of bauxite was consumed in alumina production and the remainder for other uses such as in the chemical industry, and for production of cement, abrasives, and refractory products. In 1969, 715,000 tons of alumina was used in aluminum production.

Because of lack of cheap electricity, French production of primary aluminum during 1966–68 did not vary much from the level of 365,000 tons per year; in spite of excellent market conditions, the 1969 output was about 2 percent more than in 1968. However, production of secondary metal, semimanufactures and casting increased. Die castings accounted for one-third of all aluminum castings.[5]

[5] Aluminum (Duesseldorf). V. 46, No. 1, January 1970, pp. 6 and 7.

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Thanks to a new agreement with Electricité de France, primary aluminum production is scheduled to increase by 30,000 tons. Also, the Groupe Pechiney, France's principal aluminum producer, is expanding its production facilities abroad. The company is building an electrolytic plant at Frederick, Md. with two potlines each with 80,000 tons annual capacity and plans to build an aluminum plant at Vlissingen, Netherlands, the first section of which should come into operation in the fall of 1971. The company also increased its production capacity in Greece by 10,000 tons.

Apparent aluminum consumption in France increased 22 percent to 430,000 tons, of which 350,000 tons was primary aluminum and the remainder, secondary aluminum. Principal domestic aluminum consumers and their shares of consumption (excluding exports) in 1968 were as follows, in percent: Transportation 31.5; electrotechnology 15.6; packaging 9.6; building industry 9.2; machinery 7.5; household 7.2; iron and steel industry 6.4; metal wares 2.7; chemical and food industry and agriculture 2.4; aluminum powder users 0.8; and miscellaneous 7.1.[6]

Imports and exports of primary aluminum were 142,273 tons (including 20,545 tons of alloys) and 179,806 tons (including 65,245 tons of alloys) respectively. The export surplus of 89,000 tons in 1968 was reduced to 38,000 tons in 1969 because of the strong demand in the French market. However, the greater part of aluminum imports came from sources with which Pechiney and Ugine are associated.

France also imported 4,974 tons of calcined alumina and exported 253,511 tons. Almost half of this tonnage was exported to Switzerland. Pechiney and Kaiser Aluminum plan to build an alumina plant in the Dunkirk area.

Copper.—Apparent consumption of copper increased 13 percent to 335,000 tons. All but about 10 percent of the consumption requirements are normally met by imports. Trade in copper was as follows, in tons:

IMPORTS	
Matte	1,392
Scrap:	
Copper	1,728
Brass and bronze	11,419
Metal	[1] 340,292
Semimanufactures	[2] 39,757
EXPORTS	
Meatte	913
Srap:	
Copper	6,605
Copper alloys	34,424
Metal	16,155
Brass, bronze, and other copper alloys	2,083
Semimanufactures	[3] 37,935

[1] Includes 292 tons of brass and 1,090 tons of bronze.
[2] Includes 1,869 tons of powder and flake. Of the total, copper semimanufactures account for 19,141 tons; the remainder were copper alloy semimanufactures.
[3] Includes 249 tons of powder and flake.

In addition to the above, France exported 7 tons of copper beryllium alloys and 111 tons of cupriferous alloys. Some of the exported scrap is returned to the country in form of products.

Principal sources of copper metal imports were Belgium (102,000 tons), Zambia (67,000 tons), Chile (53,000 tons) Congo (Kinshasa) (33,000 tons), and the United States and West Germany (each 22,000 tons).

Copper prices increased from US$1,211 per ton in January to US$1,780 in December.

Iron Ore.—Iron ore production increased fractionally but shipments to the domestic and foreign consumers increased by 2.4 percent, with a concomitant reduction in stocks. It is expected that the output of Lorraine will remain at about the current level through 1975 but that production of the western mines will drop to 2 million tons per year. Productivity continued its increase, and in the Lorraine field, 27.87 tons per man shaft was produced by underground and surface workers; the corresponding figure for the western mines was 11.06 tons. Employment in the industry dropped by 766 to 12,387. The industry invested about $15 million.

According to official trade statistics, there has been little variation in iron ore exports from France, which totaled 18,515,468 tons in 1969. There were only two significant destinctions for this ore, the Saar area of West Germany and Belgium-Luxembourg, which received 5,058,582 tons and 13,439,553 tons, respectively, of French ore in 1969. Exports to Belgium-Luxembourg was slightly

[6] Ernst, Lenore-Aluminium (Duesseldorf). V. 45, No. 12, December 1969, pp. 781–785.

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less than in 1968, but this decrease was more than compensated for by increased exports to the Saar. The decline of exports to Belgium-Luxembourg is significant because pig iron production in Belgium was 8 percent and in Luxembourg 13 percent more than in 1968, indicating a gradual shift to higher grade ores from other sources, particularly in the case of Belgium. France increased its iron ore imports to 6,940,950 tons; Brazil, Liberia, and Mauritania were the three principal sources.

Table 5.—France: Marketable iorn ore production by basin and total iron ore shipments and stocks

(Thousand metric tons)

	1967	1968	1969
PRODUCTION			
Lorraine	46,043	52,274	52,868
West	3,136	2,945	2,545
Centre-Midi	42	19	12
Total	r 49,221	55,238	55,425
Iron content	r 15,476	17,177	NA
SHIPMENTS			
Domestic	33,910	36,800	37,579
Other EEC countries	17,187	18,355	18,731
Other countries	83	72	226
Total	51,180	55,227	56,536
Stocks	6,067	5,730	4,380

NA Not available. r Revised.

Iron and Steel.—*Production Consumption, and Trade.*—Increases in pig iron and crude steel production in France compared favorably with that in 1968 (10.2 and 10.7 percents, respectively) and with the increases in the European Economic Communities (EEC). The increase was achieved in spite of strikes that caused an estimated 1 million ton production loss. Production capacity for crude steel, estimated at 25 million tons in 1969, is expected to increase to 26 million tons by mid-1970; a 1970 output of 24 million tons is expected. The production of all categories of rolled steel increased.

On the technological side, more sinter and oxygen iron was produced. Iron ore used directly in blast furnaces for pig iron production showed a slight decline, but there was a substantial increase in tonnage of sinter in the blast furnace charge. Rapid progress was also made in oxygen steelmaking; 1,242,000 tons more steel was made by this process. The production of all categories of rolled steel increased.

Temporary rebates on steel prices were fully eliminated in two steps in January and July 1969. French steel prices were increased an average of 4 percent in October and another 9 percent on December 31. Nonetheless, French steel prices were still lower than the corresponding prices in the EEC.

Table 6.—France: Salient iron and steel industry statistics

(Thousand metric tons unless otherwise specified)

	1967	1968	1969
SINTER			
Production	21,065	22,796	27,160
Raw material consumption:			
Iron ore	25,433	27,259	31,254
Furnace dusts	1,007	1,016	1,117
Manganese	30	10	40
Pyrite cinder	26	23	19
Other iron-bearing materials	685	977	1,332
Limestone	702	690	636
PIG IRON			
Number of blast furnaces:			
Available	124	109	99
In operation at yearend	83	74	75
Maximum production capacity	19,650	19,540	21,000
Production:			
Thomas	12,085	12,686	13,326
Hematite and semihematite (steelmaking)	2,359	2,506	3,385
Phosphorus (foundry)	207	188	203
Hematite and semihematite (foundry)	625	581	721
Special pig iron (foundry)	115	115	150
Spiegeleisen and high-carbon ferromanganese	320	374	427
Total [1]	15,710	16,450	18,212

See footnotes at end of table.

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Table 6.—France: Salient iron and steel industry statistics—Continued

(Thousand metric tons unless otherwise specified)

	1967	1968	1969
PIG IRON—Continued			
Raw material consumption for pig iron production:			
Iron ore directly in blast furnaces	16,968	14,323	18,031
Iron ore sinter	21,064	22,531	26,120
Manganese ore:			
In blast furnaces	562	687	781
In sintering plants	30	10	40
Metallurgical rejects	931	963	1,136
Scrap	426	315	204
Limestone	231	97	125
Phosphatic limestone	1	1	------
Coke in blast furnaces	10,931	11,261	11,834
STEEL			
Number of furnaces in operation:			
Thomas converters	89	92	77
Open hearth	52	51	49
Electric	112	107	99
Oxygen	9	10	13
Maximum production capacity (all furnaces)	23,900	24,340	e 25,000
Production of crude steel:			
Thomas	10,112	10,507	10,664
Open hearth	4,284	4,072	4,468
Electric	1,905	2,068	2,371
Bessemer	67	57	61
Kaldo, LD, and similar	3,287	3,705	4,947
Total	19,655	20,409	22,511
Ingots	19,309	20,025	22,074
Liquid steel for casting	346	385	438
Material consumption for steel:			
Pig iron, spiegeleisen, and ferroalloy	14,796	15,646	17,027
Scrap	6,826	6,787	7,688
Liquid Thomas steel	129	158	166
Lime	1,831	1,915	2,016
Limestone	114	102	156
Iron ore	207	258	321
Fluorspar	33	NA	NA
Consumption per ton of crude steel:			
Pig iron kilograms	740	767	756
Scrap do	364	333	342
Rolled steel production:			
Rails and accessories	283	302	319
Heavy structural	1,143	1,209	1,346
Wire rods	2,106	2,353	2,442
Bars	3,333	3,518	3,746
Pipe skelp	558	589	684
Other	18	16	18
Flat products:			
Wide plates	96	104	111
Hot rolled sheets:			
Thickness, 4.76 millimeters or more	1,354	1,369	1,644
Thickness, 3 to 4.76 millimeters	514	488	544
Thickness, less than 3 millimeters	600	482	426
Cold rolled sheets: Thickness, less than 3 millimeters	3,825	4,205	4,982
Hot-rolled strips for tubes	1,017	1,076	1,226
Subtotal flat products [1]	7,406	7,723	8,933
Total rolled steel production [1]	14,847	15,711	17,487
Tubes	1,366	1,465	1,712
Galvanized and other plated sheets	522	516	720
Condenser sheets	178	168	186
Tinplate	691	662	781
Total consumption of iron and steel industry:			
Iron ore	46,664	41,840	44,531
Manganese ore	593	697	821
Scrap [2]	7,253	7,101	7,892
Coke	12,145	12,370	12,706
Coal other than coking coal	1,935	1,931	2,259
Coking coal	5,502	5,543	5,977
Fuel oil and gas oil	1,510	1,576	1,832
Thomas slag production	2,517	2,677	2,819
Average total employment (workers and staff)	114,102	108,647	108,514

e Estimate. NA Not available.

[1] Data may not add to totals shown because of independent rounding.

[2] Excludes scrap used by rolling mills in tons as follows: 1967, 108,080; 1968, 107,644; 1969, 122,733.

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Apparent consumption of crude steel rose by an estimated 25 percent to 23.3 million tons with deliveries to the domestic market 13.1 million tons (10.9 million tons in 1968). Rates of increase were highest for hot and cold rolled sheets under 3 millimeters (32 percent), universals and plates, 3 millimeters and over (30 percent), wire rods (24 percent), and hot rolled strip, including tube strip (17 percent). Factors contributing to the increase were higher production of motor vehicles and high level of activity in the capital goods industries. The increase in the output of these industries as compared with 1968 were as follows, in percents:

Motor vehicles	18.3
Heavy mechanical engineering goods	22.0
Sheet metal industry	23.0
Structural steel products	17.0

Domestic steel shipments were distributed as follows, in thousand tons: For conversion 3,456; to steel merchants 3,548; to manufacturing industries 3,585; to extractive industries, railroads and building industry 1,225; others 210; and alloy steels 1,096.[7]

France's iron and steel trade by principal product categories were as follows, in thousand tons:

Commodity	Imports	Exports
Pig iron	229	74
Ferroalloys	107	334
Shots, powder and sponge	21	22
Scrap	464	2,229
Steel:		
Ingots, blooms, and billets	784	482
Coils	1,084	155
Rolled Steel	4,275	5,052
Pipes, tubes and accessories	285	823
Total steel	6,428	6,512

The net steel exports of 1968 (1,859,000 tons) was considerably reduced in 1969 because of higher imports to meet consumption demands. Sheets, plates, and strips accounted for 2,478,000 tons of imports and 2,423,000 tons of exports. As in the previous years, ingots and coils for rerolling were a significant part of steel imports because steel furnace capacity is not sufficient to meet rolling mill requirements.

Industry Developments.—Investment in the industry in 1968 totaled $256 million or $12.60 per ton of steel output; the corresponding investment expenditure in 1969 is estimated at $270 million. Investment is expected to increase to $360 million in 1970. Total indebtedness of the industry decreased from 80 percent of the annual sales volume at the end of 1968 to 69 percent at the end of 1969. This decrease was due to sales, which increased to about $2.6 billion, compared with $2.1 billion in 1968.

Union Sidérurgique du Nord de la France (Usinor) is planning to raise crude steel capacity of its Dunkirk plant to 8 million tons per year by 1974. Coking capacity will also be doubled to 1.6 million tons per year. The addition of a cold-rolling mill and an electrolytic tinplate mill will bring rolling mill facilities in balance with the added crude steel capacity.

Modernization and rationalization measures undertaken in 1968 in the special steel sector of the industry bore fruit in 1969—production of special and alloy steel ingots increased to 1,871,000 tons (1,489,000 tons in 1968). The two leading producers of alloy steel Compagnie des Forges et Ateliers de la Loire (CAFL) and Société des Forges et Ateliers du Creusot (SAFC, a subsidiary of the Schneider Group) were reported to have agreed to coordinate their investment for flat products and were negotiating to do the same for other products. Greater rationalization of production and coordination of research and sales between the two companies were indicated. The two companies have 850,000 tons total capacity.

Fos, near Marseilles, was chosen as a site for a new modern steel complex. This plant will have oxygen steel furnaces and hot-rolling mills; in its final stage in 1977–78 the plant will have a capacity of 7.5 million tons of crude steel. The plant will consist of three large blast furnaces, three oxygen converters, and a hot wide strip mill, which will be the largest in Europe with 6-million-ton annual capacity.

Adjacent to the Fos steel complex, Ugine Kuhlman plans to build a plant to produce stainless and special steels. The works will have an annual capacity of 600,000 tons; initial production will begin in 1972 and will reach full capacity by 1975.[8]

[7] Organization for Economic Cooperation and Development. The Iron and Steel Industry in 1969 and Trends in 1970. Paris, France, 1969, table 26.
[8] Metal Bulletin (London). No. 5467, Jan. 20, 1970, p. 25.

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Lead and Zinc.—The increase in production of lead concentrate to 41,000 tons was accompanied by a decline in production of zinc concentrates from 39,000 tons in 1968 to 36,000 in 1969. This resulted partly from the closure of the Pierrefitte mine, which produced zinc ore. Largentère mine, which came into full production in 1969, is primarily a producer of lead ore.

The output and consumption of both metals increased. The Viviez plant of Société des Mines et Fonderies de Zinc de la Vieille Montagne produced 94,000 tons of electrolytic zinc. The company has put into operation new roasting facilities and sulfuric acid plant.

Refined lead and slab zinc consumption in 1969 totaled 198,500 and 239,000 tons, respectively compared with 179,300 and 202,300 tons in 1968. In 1969 total lead and zinc consumption as reported in the July 1970 issue of World Metal Statistics (London) was as follows in thousand tons:

LEAD	
Storage batteries	86.7
Cable sheathing	42.0
Pipe	14.0
Sheet and strip	14.0
Foil	5.0
Shot	10.0
Tetraethyl	13.5
Chemicals	22.8
Alloys	17.0
Miscellaneous	7.1
Total	232.1
ZINC	
Galvanizing	77.2
Die-casting alloys	33.8
Copper alloy castings	4.0
Copper alloy semimanufacture	59.8
Rolled zinc	70.6
Oxides	34.7
Other chemical uses	14.7
Zinc wire and tubes	3.7
Miscellaneous	1.5
Total	300.0

The trade in these metals for 1969 were as follows in tons:

Commodity	Imports	Exports
LEAD		
Ore	123,735	4,333
Scrap	4,981	14,670
Metal and alloys	58,450	19,095
Semimanufactures	621	1,191
ZINC		
Ore	412,477	7,126
Scrap	18,439	2,155
Metal and alloys	31,231	20,381
Semimanufactures	[1] 14,052	[2] 4,976

[1] Includes 4,366 tons of zinc powder and 4,512 tons of zinc manufactures.
[2] Includes 2,352 tons of zinc powder.

Lead ore imports were mainly from Ireland, Yugoslavia, Bolivia, and Australia; zinc ore imports were from Canada, Peru Ireland Morocco and Sweden. Morocco, Tunisia, and West Germany were principal sources of lead metal imports, and the EEC was the principal supplier of zinc metal. Lead metal was shipped mainly to the United States, Switzerland, and Greece; zinc metal was shipped mainly to the EEC countries.

Nickel.—During the year, Société Le Nickel took a majority interest in the capital of the Société Minière et Métallurgique de Peñarroya and continued its expansion program in New Caledonia with the objective of increasing nickel production capacity to 69,000 tons. During the year, the first two 11,000 kilowatt furnaces for producing ferronickel came into operation. The company initiated a $250 million investment program in the north of New Caledonia with a view to produce ferronickel with a 40,000-ton nickel content.

By yearend the French Government had not acted on proposals of American Metal Climax and Peñarroya to become New Caledonia's third nickel producer, the others being Société Le Nickel and Cofimpac. The latter was organized in 1967 as a consortium of International Nickel Company and Société Auxilaire Minière du Pacifique (Sampac). Peñarroya and American Metal Climax formed a French registered company, Penamax, to represent their joint nickel developments in New Caledonia.[9] The merger of Peñarroya and Société le Nickel may be a factor in the final decision.

Nickel trade in 1969 was as follows:

IMPORTS	
Matte	6,056
Intermediate metallurgical products other than matte	7,148
Scrap:	
Nickel	51
Nickel alloys	22,637
Ferronickel	610
Nickel anodes	251
Nickel metal	8,413
Semimanufactures	2,350
EXPORTS	
Matte and similar products	155
Scrap:	
Nickel	176
Nickel alloys	1,459
Ferronickel	169
Anodes	705
Nickel metal	7,045
Semimanufactures	2,187

Tin.—Actual tin consumption by principal users in 1968 and corresponding esti-

[9] Metal Bulletin (London). No. 5461, Dec. 31, 1969, p. 18.

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mates for 1969 were as follows, in long tons:

End use	1968 [1]	1969 [1]
Tinplating	5,305	5,748
White alloys	2,716	3,292
Copper alloys	743	823
Chemical products	399	408
Semimanufactures	271	344
Miscellaneous	162	161
Total	9,596	10,776

[1] J. Branconnot & Cie, Paris, France. Private correspondence.

France's tin trade was as follows in long tons:

Commodity	Imports	Exports
Concentrate	79	359
Metal	10,925	279
Alloys	216	281
Scrap	79	14
Semimanufactures	34	129

It is estimated that France recovers about 2,000 long tons of tin from scrap and detinning of tinplate.

Titanium.—Titanium-Trioxide S.A., a wholly owned subsidiary of British Titan Products, will increase the annual capacity at its titanium dioxide pigment plant in Calais to 60,000 tons. The present capacity of this plant, completed in 1967, is 25,000 to 30,000 tons of titanium dioxide per year. The sulfuric acid process is used at this plant and will be used in the expanded facilities which are scheduled for completion in 1971.

Tungsten.—Production of scheelite from the deposit near Salau in the French Pyrenees was expected by yearend 1970. The mine will be operated by the Société Minière d'Anglade in which Charter Consolidated Limited of the United Kingdom and Anglo-American Corporation of the Republic of South Africa hold a 40 percent interest. The Enguiatès mine in the Aveyron area of Société miniere et métallurgique du Chatelet also started production.

France imported 2,747 tons of tungsten minerals, a 70-percent increase compared with 1968, brought about by increased ferrotungsten production.

Uranium.—France produced 609,000 tons of uranium ore, averaging 0.21 percent uranium content. The French Atomic Energy Commission imported 402 tons of uranium, as concentrates, from Gabon.

Uranium mines of the Franc area were to set up a joint marketing organization (Uranex) that would market approximately 2,000 tons of uranium per year. The partners in Uranex would be the French Atomic Energy Commission (34 percent), Compagnie Pechiney Mokta (33 percent) and the Compagnie Française des Mines d'Uranium (33 percent).[10] France and Indonesia reached an agreement in April with a 7 year uranium exploration program in Kalimantan.

NONMETALS

Data for the quarry products, the most important nonmetals produced, are not available for 1969. Preliminary figures for some items indicate a 17-percent increase in the output of limestone used by the iron and steel industry and sugar refineries, a 1-percent increase in alluvial sand and gravel output, and a 1.5-percent decline in road building materials other than alluvial sand and gravel. In 1968, the value of crude nonmetals produced were as follows in million dollars:

Quarry products	610
Other nonmetals	192
Total nonmetals	802

Quarry products accounted for 36 percent of the value of all mineral output and 76 percent of all nonmetals.

Cement.—Salient statistics of the cement industry in 1969 were as follows, in thousand tons, unless otherwise stated:

Yearend production capacity	33,850
Production, all types	27,543
Employment number	14,000
Imports:	
Clinker	65
Portland and other	27
Exports:	
Clinker	370
Portland and other	636
Apparent consumption	27,000
Per capita consumption, kilograms	570

During the year, cement production capacity was increased by about 850,000 tons per year owing to improvement in existing plants and replacement of three kilns.

Cement output by type in the 1966–68 period was as follows:

[10] Mining Journal (London), Oct. 10, 1969, p. 321.

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Type	Thousand metric tons		
	1966	1967	1968
Portland	18,031	19,232	20,651
Slag:			
Blast furnace	2,341	2,257	2,373
Other	1,211	1,407	851
Special	1,001	866	834
Total [1]	22,584	23,763	24,709
Natural	81	104	48
Mortar	638	551	637
Grand total [1]	23,304	24,418	25,393

[1] Data may not add to totals shown because of independent rounding.

Fertilizer Materials.—Apparent consumption of potash and internal shipments were 1,298,850 and 1,300,190 tons of K_2O respectively. During the year the French potash industry was carrying out a rationalization program in an effort to reduce the number of mining and treatment centers to three —Amelie, Marie-Louise, and Théodore. The Amelie and Marie-Louise mines are being expanded to produce 2,600 and 1,700 tons of ore per day, respectively, from the current level of 1,100 and 1,250 tons per day. The two mines now account for half of the ore output. At Marie-Louise mine treatment facilities (new dissolution units, facilities for washing residues, crystallization equipment, rotary drying kiln, and addition storage facilities) were expanded and a new shaft was sunk at Staffelfelden. Belt conveyors at Théodore replaced the aerial ropeway. Improvements in the rail transportation system serving the mines were underway.[11]

The phosphoric acid plant of Société Chimique des Charbonnages will increase its production of mixed fertilizers.[12]

France's fertilizer trade in 1969 was as follows, in thousand tons:

Type	Imports	Exports
Nitrogenous:		
Crude	24	(1)
Processed	349	514
Phosphatic:		
Phosphate rock	3,523	(1)
Thomas slag	942	280
Superphosphates	382	53
Potassic:		
Crude	24	----
Potassium chloride	123	959
Potassium sulfate and other	75	127
Mixed	953	302

[1] Less than ½ unit.

In terms of value, imports and exports of mineral-based fertilizers totaled $147 million and $65 million, respectively.

Fluorspar.[13]—France's probable fluorspar reserve at yearend 1968 was estimated at 14 million tons, with an average grade of 48 percent CaF_2 or 7 million tons with 80 percent CaF_2. Fluorspar consumption in 1968 was estimated at 153,000 tons, of which 98,000 tons were chemical grade. In 1969 France exported 102,226 tons of fluorspar and imported 6,729 tons. Fluorspar exported from France is substantially of metallurgical grade; fluorspar imports are of acid grade.

The Société Denain-Anzin Minéraux reportedly has started producing fluorspar pellets made by agglomerating ferruginous fluorspar "sand" using bauxite as a binder. The pellets can be used in the steel industry, especially in oxygen converters.

Sulfur.—The 14-percent increase in natural gas production brought about an increase in recovered sulfur. However, exports declined by about 200,000 tons to 864,458 tons, presumably because of higher domestic consumption. Sulfuric acid production increased to 3,528,000 tons in 1969, compared with 3,349,000 tons in 1968. France imported 351,519 tons of sulfur in 1969.

MINERAL FUELS

France's consumption of primary energy in 1969 totaled 213.9 million tons of standard coal equalivalent (SCE) and domestic sources supplied 39 percent. Consumption of the different fuels and hydroelectricity in the last 3 years were as follow in million tons SCE:

	1967	1968	1969
Solid fuels	63.6	62.3	62.4
Petroleum products [1]	92.0	101.0	115.8
Gas	10.0	12.0	18.1
Electricity	20.0	21.9	22.6
Total	185.6	197.2	213.9

[1] Petroleum used only for energy production.

Source: Annales des Mines (Paris), July-August 1970, p. 11.

Thus the share of domestic and imported solid fuels in total energy consumption declined from 31.6 percent in 1968 to 29.2 percent in 1969. In terms of domestic consumption of the different energy forms, France was self sufficient in electricity and

[11] Phosphorus and Potassium (London). No. 45, January-February 1970, pp. 40–41.
[12] Bulletin de l'Industrie Pétrodière. Mar. 6, 1970, p. 1.
[13] A. Chermitte. "Le Spath-Fluor Français en 1968." Mines et Metallurgie (Paris), No. 3644, January 1970, p. 13–15.

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supplied about three-fourths of solid fuels and gas consumption and less than 3 percent of petroleum needs.

Energy consumption by ultimate users (shipments to the internal market), totaled 186 million tons SCE, with the following breakdown in million tons SCE: Iron and steel industry 20.1, industry excluding iron and steel 73.7, households 53.9, and transportation 35.1 [14].

Coal.—Production of coal (anthracite and bituminous) declined relative to 1968, a year in which there was almost 5.7 million tons of production loss, 2.2 million tons attributable to the strikes in May. However, output per man-shift increased: 7.4 percent for underground workers and 6.4 percent for underground and surface workers. Of the total output of bituminous coal, Nord/Pas-de-Catais accounted for 18.9 million tons, Lorraine accounted for 13.9 million tons, and Centre-Midi accounted for 7.8 million tons. The labor force declined more than 10 percent during the year.

[14] Annales des Mines (Paris), July-August 1970, p. 5.

Table 7.—France: Salient statistics of the coal and lignite industry
(Thousand metric tons unless otherwise specified)

	1967	1968	1969
COAL			
Production:			
Anthracite	2,880	2,775	3,086
Semianthracite	9,152	7,827	6,998
Bituminous:			
Low volatile [1]	3,715	3,712	3,209
Medium-volatile [2]	12,415	10,746	10,533
High-volatile [3]	16,561	14,338	14,103
High-volatile [4]	2,901	2,513	2,654
Total [5]	47,625	41,911	40,584
Apparent consumption (including lignite) thousand tons of standard coal equivalent	63,700	61,600	NA
Stocks at yearend	11,723	10,507	7,878
Number of operating mines	61	58	52
Average number of days worked	260	247	255
Average daily output, metric tons	183,300	169,900	159,300
Number of men working daily at yearend:			
Underground, persons	94,292	83,776	74,143
Surface, do	39,679	38,259	35,336
In associated plants, do	8,625	5,145	4,883
Production per man-shift:			
Nord/Pas-de-Calais:			
Underground, kilograms	1,805	1,842	1,978
Underground and surface, do	1,252	1,245	1,319
Lorraine:			
Underground, do	3,703	3,888	4,175
Underground and surface, do	2,443	2,483	2,676
All of France:			
Underground, do	2,241	2,347	2,522
Underground and surface, do	1,523	1,555	1,654
LIGNITE			
Production	2,931	3,221	2,950
Stock at yearend	379	233	254
Average number of days worked	260	247	255
Average daily output, metric tons	10,400	11,700	11,600
Number of men working at yearend:			
Underground, persons	1,515	1,451	1,385
Surface, do	1,053	1,034	2,383
Associated plants, do	130	132	142
Production per man-shift: [6]			
Underground (Provence), kilograms	4,870	5,165	5,413
Underground and surface, do	NA	NA	3,205

NA Not available.
[1] Largely 14 to 18 percent volatile matter; a small tonnage has a higher volatile content.
[2] 16 to 28 percent volatile matter.
[3] 25 to 41 percent volatile matter.
[4] 40 to 42 percent volatile matter for the bulk of production in this category.
[5] Detail does not add to total (official data) because of differences in source.
[6] Productivity at the opencast lignite mine of the Landes region is 23,738 kilograms per man-shift.

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By 1975, seven coal mines in the central and southern coal mining districts are scheduled to close down.[15] French coal production in that year is planned not to exceed 25 million tons. Gross loss in 1969 by the industry before amortization totaled $209 million and including amortization $298 million.

The number of operating mines in 1969 declined further—two mines were closed in the Nord/Pas-de-Calais field. Output per mine decreased to 3,084 tons compared with 3,127 tons in 1969 but daily output per working face increased to 319 tons (278 tons in 1968). In October 1969, 76.6 percent of the underground output was from mines with mechanized extraction and haulage. Semimechanized mines accounted for 14.7 percent of the output; nonmechanized mines and other accounted for the remainder. Nonetheless, production cost per net ton of coal in 1969 increased to $18.81, from $18.53 in 1968. In 1969 labor costs accounted for 64 percent of production cost, and supplies accounted for 21.5 percent; the remainder being overhead, taxes, and other expenses.

Investment in coal mines in 1969 totaled $57 million, of which $27 million was for mining purposes.

Nearly 89 percent of the coal output in 1969 was prepared in coal washeries with an hourly capacity of 19,670 tons. Heavy media units accounted for 56.3 percent of coal perparation capacity.

Consumption and Trade.—Coal sales in 1968 totaled 51.7 million tons, 35.9 million tons of which was domestic coal. Corresponding figures for 1969 were 51.9 million and 36.1 million tons. In 1969, coal supply from domestic mines and stocks and net imports totaled 54.2 million tons, about the same as in 1968. Shipments of domestic and imported coal for making coke increased to 17,650,000 tons (16 million tons in 1968) and shipments to electricity producers was 17,133,000 tons (16,736,000 tons in 1968). Household and small industries were the other principal recipients of coal. In 1969, coal mines accounted for 8.4 percent of the 130,600 million kilowatt hours of electricity produced in France.

France's solid fuels trade was as follows, in thousand tons:

[15] Colliery Guardian (London). October 1969, p. 550.

	Imports[1]	Exports[1]
Coal	9,661	662
Anthracite	2,856	440
Other solid fuels	261	43
Lignite and lignite briquets	309	17
Peat and peat briquets	39	2
Coke and semi-coke	3,290	888

[1] Data from the official trade book and are somewhat different from the source cited in table 8.

Table 8.—France: Production, availablity, and distribution of coal
(Thousand metric tons)

	1968	1969
Net production	41,911	40,584
Middlings, foreign coal, etc	101	167
Stock variations [1]	−1,251	−2,656
Total availability	43,263	43,407
Consumption by mines and mine powerplant	6,185	6,450
Delivery to miners	725	605
Delivery for transformation:		
Mine coke ovens	8,711	9,477
Steel plant coke ovens	2,100	1,968
Gas coke ovens	29	3
Briquetting plants	3,549	3,369
Total	21,299	21,872
Exports	866	1,089
Total available from domestic production [2]	21,198	20,522
Imports	11,512	11,842
Delivery from imports:		
Coal mine coke ovens	1,545	1,942
Steel plant coke ovens	3,466	4,263
Gas coke ovens	194	22
Briquetting plants	775	623
Stock variations [1]	−431	−712
Available from imports	5,718	5,704
Available for domestic distribution	26,914	26,226
Railroads	512	487
Gasworks	11	11
Electricity	10,551	10,683
Iron and steel	1,943	2,212
Other industries	6,496	6,119
Domestic and small industries	7,401	6,714

[1] Plus (+) denotes addition to stocks, minus (−) denotes withdrawal from stocks.
[2] Adjusted for small tonnages of foreign coal used by mines and stock changes.

Source: Bureau de Documentation Minière, Combustibles Minéraux Solides. Statistique Annuelle Définitive. Paris, France, pt. 2, 1969.

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Principal suppliers of coal and anthracite were West Germany (6,605,000 tons), the United States (1,943,000 tons) the U.S.S.R. (1,393,000 tons) and Poland (1,103,000 tons). The U.S.S.R. was the largest supplier of anthracite (1,279,000 tons). Average c.i.f. value per ton of bituminous coal was $14.14 and of anthracite $24.65.

Coke and Coal Chemicals.—In 1969 French coal mines had a capacity to produce 25,600 tons of coke per day and established a record coke output of 9,020,000 tons. Nord/Pas-de-Calais produced 60 percent of the coke in 1969. Production at the coke ovens of mines and steel plants and shipments to the two principal consumers increased. Increase in coke output of steel plants resulted partly from the operation of the new coke oven at Dunkirk which started operation in September. In 1968, coke ovens produced 534,550 tons of crude tar 333,000 tons of which were from coke ovens of mines.

Natural Gas.—Production of natural gas in Meillon-Saint Faust-Pont d'As fields increased French marketable gas output to 6.5 billion cubic meters. Reserves at the beginning of 1968 were 215,000 million cubic meters proved and 85,000 million cubic meters (probable). New gas treatment facilities will increase daily capacity to 34 million cubic meters by 1970.

In addition to domestic production, France imported 2.1 billion cubic meters of natural gas from the Netherlands and 500 million cubic meters from Algeria. Imports from the last source will increase to 4 billion cubic meters per year when the liquefaction plant at Skikda, Algeria, is built. Natural gas accounted for 76 percent of total gas supply, the remainder being supplied by gas made from coal and petroleum.

Natural gas supplied 6.1 percent of France's energy requirements in 1969 and is expected to supply 7.1 percent in 1970 and 9.9 percent in 1975. In the latter year it is expected that sources of supply will be as follows in billion cubic meters: The Aquitaine fields 8; Netherlands 6; and Algeria 4. Gas imports from the U.S.S.R. have been under study for some time.

Table 9.—France: Production availablity and distribution of coke

(Thousand metric tons)

	1968	1969
Coal charged to coke ovens:		
Domestic	11,316	11,895
Imported	5,240	6,038
Total	16,556	17,933
Production:		
Oven coke:		
At mines	8,073	9,020
At iron and steel plants	4,211	4,555
At gas companies	219	30
Total	12,503	13,605
Availability and distribution:		
Coke produced	12,503	13,605
Receipt of coke fines	28	5
Consumption at coking plants and by labor	759	787
Available for distribution	11,772	12,823
Stock variation [1]	−199	−409
Imports	3,348	3,358
Importer's stock variation	−92	−140
Total available from domestic production and imports	15,411	16,730
Delivery to coking plants	36	------
Exports	259	902
Net available	15,116	15,828
Distribution:		
Iron and steel	12,422	13,057
Other industry	1,752	1,855
Domestic use and small industry	895	872
Railroads	47	44
Total	15,116	15,828

[1] Plus (+) denotes addition to stocks, minus (−) denotes withdrawal from stocks.

Source: Bureau de Documentation Minière, Combustibles Minéraux Solides. Statistique Annuelle Définitive. Paris, France, pt. 2, 1969.

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However, at this time it is not clear when such imports will begin. They will probably begin sometime in 1975 or thereafter, starting with 2.5 billion cubic meters per year. West Germany has expressed willingness to let Soviet gas transit its territory for French destinations.

Natural gas from Leeuwarden field in the Netherlands discovered by Petroland and its associates will be delivered to Gasunie of the Netherlands, and the latter will deliver an equivalent to France under contractual arrangements with Petroland.

Gas de France has launched an investment program costing about $170 million. The expenditure will be devoted to production facilities, long distance transport, and to distribution. Two regasification plants at Fos will be built to handle additional Algerian gas, which will arrive at Fos starting in 1972.[16]

Petroleum.[17]—There was a further decline in domestic crude production, but national refinery throughput increased 13 percent to 90.6 million tons, including 4.9 million tons custom refining. Franc zone crude supplied one-third of the refinery throughput exclusive of the custom refining tonnage. The refining capacity of 105.2 million tons was 8.1 percent more than at the beginning of the year. Civilian consumption of petroleum products increased 11.8 percent to 70.6 million tons. Net refinery output totaled 84.3 million tons. Imports of petroleum and petroleum products[18] totaled 86.3 million and 5.2 million tons, respectively, with a value of $1,447 million or 9.1 percent of all imports by value. In addition, natural gas imports were valued at $32 million. France also exported 14.2 million tons of products valued at $152 million. Custom duties, taxes, and other duties on petroleum ($2.84 billion) accounted for 10.8 percent of budgetary receipts. Petroleum supplied about 54 percent of France's energy consumption; this figure is expected to increase to 67 percent in 1975.

[16] Petroleum Press Service (London). V. 37, No. 6, June 1970, p. 227.

[17] Source: Union des Chambres Syndicales de l'Industrie Pétrolière (Paris). Bilan de l'Industrie Pétrolière Française 1969 et Prespectives pour 1970, 12 pp. and Comité, Professionel du Pétrole. Eléménts Statistiques. Activitié de l'Industrie Pétrolière (Paris). V. 1, 1969.

[18] Including nonenergy products such as petroleum jellies, paraffins, waxes, and residues such as petroleum coke and bitumens, as well as LPG's.

Table 10.—France: Salient statistics of petroleum and natural gas industry

(Thousand metric tons unless otherwise specified)

	1967	1968	1969
Length of hole drilled—thousand meters	120	104	96
Production:			
Crude petroleum	2,832	2,688	2,499
Natural gas—million cubic meters	8,552	8,630	9,779
Marketed—do	5,563	5,682	6,506
Products obtained from refining natural gas:			
Liquefied products	480	462	554
Sulfur	1,636	1,608	1,732
Refining:			
Number of refineries—units	19	20	22
Capacity of refineries (atmospheric distillation)	83,805	97,340	105,240
Refinery throughput	75,202	80,300	90,592
Refinery production:			
Aviation gasoline	68	59	58
Motor gasoline	11,420	11,306	12,107
Special gasolines	1,793	2,381	2,783
Kerosine and white spirits	233	172	160
Jet fuels	2,389	2,285	2,483
Fuel oil:			
Distillate	6,278	6,086	8,122
Domestic fuel oil	18,396	22,241	24,132
Residual	22,398	22,838	26,024
Bitumen	2,688	2,833	2,853
Lubricants	930	942	1,030
Paraffins and waxes	59	54	57
Petrochemical feedstock	861	1,160	1,024
Liquefied petroleum gas	1,896	2,051	2,194
Refinery gases	944	1,218	1,179
Other	90	84	143
Total [1]	70,443	75,711	84,345

See footnotes at end of table.

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Table 10.—France: Salient statistics of petroleum and natural gas industry—Continued

(Thousand metric tons unless otherwise specified)

	1967	1968	1969
Foreign trade:			
Imports:			
Crude:			
Franc zone:			
Algeria	21,600	24,429	25,430
Other	611	437	986
Subtotal	22,211	24,866	26,416
Middle East:			
Iran	3,215	3,009	3,633
Iraq	13,576	15,160	14,731
Kuwait	8,895	7,282	8,103
Qatar	2,049	2,898	1,784
Saudi Arabia	4,279	3,986	4,848
Abu Dhabi	2,802	5,046	5,587
Total	34,815	37,381	38,685
U.S.S.R.	1,629	1,554	1,828
Venezuela	2,801	2,345	2,436
Libya	8,729	10,818	14,570
Other	2,165	213	2,371
Grand total [1]	72,348	77,176	86,306
Products [2]	4,950	5,118	5,258
Exports of products including bunkering [2]	14,099	13,289	13,959
Consumption:			
Internal market	56,814	63,158	70,602
French bunkering	1,388	1,490	1,774
Other consumption including refinery and distribution losses (approximate)	6,800	7,500	8,000
Stock (capacity):			
In refinery thousand cubic meters	21,595	24,924	30,420
In distribution channels	5,959	6,622	7,757
Transportation:			
Tankers:			
Units	90	86	85
Deadweight tons	3,923	4,538	5,144
Tank cars:			
Units	19,460	--------	17,800
Capacity thousand cubic meters	885	--------	915
Tank trucks:			
Units	14,030	15,659	17,694
Capacity thousand cubic meters	177	202	234
Employment:			
Exploration and production persons	11,075	11,343	11,266
Refinery do	16,375	16,425	16,725
Distribution do	40,580	41,300	41,800
Other do	1,586	1,650	1,698
Investment: [3]			
Exploration and production thousand dollars	54,193	68,417	81,020
Refining storage, and chemical facilities in refineries do	133,053	190,667	224,695
Distribution and storage outside refineries do	166,901	195,888	206,330
Pipelines do	22,866	55,093	20,165
Maritime transport do	38,709	64,816	57,434
Other do	52,753	34,208	33,128
Total [1] do	468,474	609,089	622,772

[1] Data may not add to totals shown because of independent rounding.
[2] Trade data differ slightly from other sources depending whether "Commerce Generale" or "Commerce Special" data are used.
[3] 1968 and 1969 estimated.

Source: Comité Professionel du Pétrole. Éléments Statistiques. Activitié de l'Industrie Pétrolière. 1965–69. Paris, France. Vol. 1.

Exploration.—Exploration activities continued to be concentrated in the Aquitaine Basin although drilling was also carried out in the Departments of Jura, Savoy, and Provence. Offshore, two wells were drilled in the Gulf of Lion (Compagnie Française des Pétroles—CFP—with participation by Société Française des Petroles B.P.) and in the Gulf of Gascony joint permit of Shell and Enterprise de Recherchés et d'Activities Pétrolières (ERAP). Drilling in the Gulf of Gascony was carried out with the semisubmersible platform "Pentagone 81". Geophysical work in France totaled 65 month team (6 percent less than in 1968) and the 95,800 meters of new drill holes was 8 percent less than in 1968. Of the drill holes, 22,000 meters

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were step-out and the remainder core and exploration drills. During the year 32 wells were completed: 22 exploration and core wells, and 10 step-out and injection wells.

Outside of France, French companies continued exploration in the areas in which they were active in 1968. The work resulted in the discovery of a petroleum structure in the Congo (Brazzaville), petroleum in offshore Iran and on land in Iraq. French companies discovered natural gas in the Red Sea area of Saudi Arabia, in the North Sea in the vicinity of Scarborough, England, and in two localities in Australia. French compaines drilled 200,000 meters of wells outside of France.

Production.—Crude production in France declined, but production in the Franc zone (Algeria and Gabon) increased to 48 million tons for Algeria and 5 million tons for Gabon. Worldwide production of crude petroleum by French companies, was almost equal to French throughput and consisted of the following components, in million tons: Algeria 43; Middle East 42; Gabon 5; Canada 1; and Libya and Tunisia 1.

Consumption.—Internal civilian consumption for all products totaled 70.6 million tons, an increase of 11.8 percent compared with 1968. Consumption by type of products and variation compared with 1968 are shown in the following tabulation:

Product	Consumption (thousand tons)	Percent of total	1969/1968 variation (percent)
Motor gasoline	11,349	16.0	+6.3
Jet fuel	1,325	2.0	+17.0
Other gasoline, kerosine, and white spirit	295	0.4	+6.0
Gas oil	4,273	6.0	+9.8
Domestic fuel oil	25,977	37.0	+13.3
Light fuel oil	2,339	3.3	+0.6
Heavy fuel oil	16,196	23.0	+19.3
Petrochemical feedstock	2,700	3.8	+24.0
LPG	1,973	2.7	+5.8
Lubricants	840	1.1	+7.6
Bitumen	2,415	3.4	+1.4
Other products	920	1.3	+3.9
Total	70,602	100.0	+11.8
Bunkers	3,550	------	+18.0

The rate of increase in the consumption of gasoline and domestic fuel oil declined compared with the 1968–67 growth rate because of the impact of higher taxes imposed on these products. The increase rate for domestic fuel oil was the smallest annual rise since 1952. The high percentage increase for jet fuel resulted partly of low 1968 consumption. Although the percentage increase for liquefied petroleum gas was 6 percent, the increase rate for propane was 18 percent.

Because of the 12.5 percent devaluation of the franc in August, prices of gasoline and gas oil increased again on September 29. The increase was about 1.4 cent per gallon for gasoline, 1.1 cent for diesel oil, and 0.97 cent for heating oil. For the Paris area prices for these products at the gas station and the percentage share of taxes in the prices as reported in the October 1969 issue of the Bulletin de l'Industrie Pétrolière (Paris) were as follows:

	Cents per U.S. gallon	Tax percentage
Premium gasoline	78	72
Regular gasoline	72	75
Gas oil	49	66

Trade.—France imported 86.3 million tons of crude, 10 million tons more than in 1968. While imports from the Middle East declined from 47 percent of total imports in 1968 to 43 percent in 1969, imports from Libya showed a corresponding increase from 13 to 17 percent of total imports. Franc zone supplied 32 percent, Venezuela supplied 2.6 percent, the U.S.S.R. supplied 2 percent, and Nigeria supplied 2.6 percent of total 1969 imports. Principal supplying countries and corresponding imports in thousand tons were: Algeria 25,430; Iraq 14,731; Libya 14,570; Kuwait 8,103; Saudi Arabia 4,848; Oman-Abu Dhabi 5,587; and Iran 3,633. France also increased its exports of petroleum

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products by about 6 percent to 14.2 million tons.

Heavy fuel oil, gas oil, and gasoline were the principal products exported, mainly to European destinations. Of the total exports 2,462,300 tons were bunkers to foreign ships.

Refining.—French refineries treated 90.6 million tons and produced 84.3 million tons of petroleum products. Of the crude processed in French refineries (exclusive of custom refining), 33 percent was from the franc zone. With the start of two new refineries, one at Valenciennes (3.5 million ton annual capacity) and one at Vernon (3 million ton annual capacity) and a 500,000 ton increase in the Berre refinery, total capacity increased to a total of 105.2 million tons at yearend. A new refinery of 4 million tons annual capacity will come into service at Hauconcourt near Metz and the two refineries at Pauillac (Shell), and Frontignan will be expanded. The annual capacity of Pauillac will be increased from 500,000 tons to 4 million tons; annual capacity of Frontignan increased from 1.7 to 4 million tons.

A steam cracking plant with an annual capacity of 200,000 tons of ethylene came into operation at Carling in August. This is the fourth ethylene plant to supply the increasing requirements of the petrochemical industry. Production of a number of petrochemical products, in thousand tons, and the increase in 1969 relative to 1968, in percents, were as follows:

	Tons	Percent increase
Ethylene	770	45
Propylene	490	45
Butadiene	125	37
Benzene (from petroleum)	220	45

The Union Chimique Elf-Aquitaine (UCEA), formed in 1968 through the merger of the chemical interests of the Elf-Erap and the Aquitaine (state-owned oil groups) has decided to invest $180 million in a petrochemical complex at Gonfreville, near Le Harve.[19]

Stocks and Storage.—Storage capacity for petroleum and petroleum products at refineries increased 5.5 million cubic meters to 30.4 million cubic meters. In addition, distributors had 7.8-million-cubic-meter capacity. According to products, storage facilities were as follows, in thousand cubic meters: Crude 10,087; intermediate products 5,918 annd finished products 22,172.

The underground storage in the salt deposit at Manosque was connected by a 98-kilometer pipeline to the Lavéra refinery; the first part of this storage faciltiy with 1-million-cubic-meter capacity came into use during the year. When completed, Manosque storage will have a capacity of 5 million cubic meters of crude oil and gas oil.

Work also started in preparing an underground storage for liquid propane at Lavéra, which will be completed in 1972 and have 75,000-cubic-meter capacity.

Transportation.—The South European Pipeline (SEP) transported 27 million tons of crude, feeding nine refineries in France, West Germany, and Switzerland. This was considerably more than that transported in 1968 (24 million tons). This pipeline is expected to transport about 32 million tons (close to its capacity) in 1970 because the Metz refinery and a refinery in West Germany will be drawing crude from this pipeline. Operation of the new refinery at Vernon caused an increase in crude transported by the Le Havre-Grandpuits pipeline to 5.5 million tons from 3.3 million tons in 1968.

The Mediteranée-Rhône product pipeline, put in service at yearend 1968, transported 2.6 million tons of products from Feyzin and Berre-l'Etang refineries to destinations in the Rhône valley, and to Lyon, Grenoble, Chambery, and Annecy. The Le Havre-Paris and Grandpuits-Paris pipelines moved 7.0 million tons of products to the Paris area and 567,000 tons to Rouen. The new Vernon refinery was connected to the Le Harvre-Paris product pipeline.

There were 50,000 gas stations in operation.

The French tanker fleet with 85 tankers increased 10 percent to 5.14 million tons total capacity with average weight of 60,500 tons per ship. Of the tankers, three are of the 200,000-ton class. Improvements at Le Havre and Fos will permit these ports to receive 200,000-ton tankers, and work is continuing so that still larger tankers may use these ports. Le Havre is favored as the port to receive the supertankers of the future (600,000 tons).

Industry Developments.—Since the transition period of the European Economic Communities came to an end at yearend

[19] Economist (London). Nov. 15, 1969, p. 72–73.

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1969, it was obligatory that France bring its oil regime in line with the requirements of the Rome Treaty, which established EEC. The Commission of EEC submitted a number of recommendations to France that would eliminate discrimination in conditions of supply and marketing among companies of member countries. Among the recommendations were the following [20]:

The obligation to obtain from French refineries 90 percent of the products marketed will have to be changed to "community refineries;"

The differentiation between Franc-zone crude and foreign crude in refining authorization must disappear.

Oil and oil products will have the right to circulate freely throughout the Community. But France and other member countries can postpone for 2 years the application of the free circulation principle.

[20] Petroleum Intelligence Weekly. V. 8, No. 52, Dec. 29, 1969, p. 5.

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The Mineral Industry of Gabon

By Agnes J. Doughman [1]

Despite an increase in both manganese and crude oil output, Gabon's economic growth will continue for the foreseeable future to depend on rational exploitation of its virtually inexhaustible timber resources.

Gabon however, still does not have the railroad that will allow opening of the unexploited mineral and timber resources of the interior of the country. The remote Mekambo region contains the vast Belinga iron ore deposits reported to contain 1 billion tons of ore averaging about 64 percent iron. A United Nations survey team was preparing a report on Gabon's unexploited copper, lead, zinc, potash, and other minerals. Approximately 20 percent of the Gabonese national budget is committed to the country's development.

Construction of the Owendo deepwater port complex has continued and the first of three berths is scheduled for completion by June 1971. When the complex is completed, it will include petroleum and timber storgae facilities, warehouses, a drydock, and an industrial zone in addition to the expected iron ore handling facilities. By 1972, it is expected to have a maximum annual capacity of 1 million tons of cargo.

Members of the Central African Customs and Economic Union (UDEAC), in 1969 composed of Gabon, Cameroon, Central African Republic, and Congo (Brazzaville), joined in reducing by 50 percent the special tariffs applied against imports from other than European Economic Community (EEC) countries. These tariffs, ranging from an extra 5 to 30 percent on most import categories, have prevented non-EEC countries from competing in the local French-dominated market except in a few categories in which no comparable EEC products were available. This tariff reduction applies to commodities not produced in one of the UDEAC countries. The tariff reductions, plus Gabon's current development plans, should open the Gabonese market to non-EEC manufacturers of such items as heavy construction and road building equipment, heavy transport vehicles, engineering equipment, and electrical machinery. In another category, pharmaceutical products, the new tariff reductions amounted to 75 percent.

[1] Statistical assistant, Bureau of Mines, Washington, D.C.

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PRODUCTION

Gabonese manganese and crude petroleum output continued a steady increase, while uranium remained at the same level as the previous year. These minerals account for about 61 percent of the total value of production, the lumber industry supplying nearly all the remainder, with only a minor contribution from cocoa, coffee, palm oil, and fish products.

Table 1.—Gabon: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Gold—troy ounces	29,250	16,724	14,243
Manganese:			
Ore 50–53 percent Mn	1,124,000	1,220,862	1,347,918
Battery and chemical grade pellets, 82–84 percent MnO_2	23,000	32,705	15,036
Uranium, concentrate 20–40 percent U_3O_8	1,452	1,371	1,383
NONMETALS			
Limestone	----------	1,253,567	e 1,300,000
MINERAL FUELS AND RELATED MATERIALS			
Natural gas, marketed—million cubic feet	611	879	863
Petroleum:			
Crude—thousand 42-gallon barrels	25,203	33,630	36,431
Refinery products:			
Gasoline—do	93	1,019	1,037
Kerosine and jet fuel—do	65	713	727
Distillate fuel oil—do	99	1,255	1,353
Residual fuel oil—do	224	1,911	e 2,053
Liquefied petroleum gas—do	6	26	39
Total—do	487	4,924	e 5,209
Refinery fuel and loss—do	17	220	e 224

e Estimate.

TRADE

Official Gabonese trade data for 1968 are not available. However, foreign trade data from the 24 industrial countries reporting to the United Nations indicate the magnitude of trade in major items.

The value of mineral exports in 1968 increased slightly over the previous year with petroleum and manganese supplying about 60 percent and 30 percent, respectively, of the total value. By the end of 1968, the value of Gabonese exports almost doubled the value of imports.

Table 2.—Gabon: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Gold—troy ounces	22,763	[1] 13,600
Iron and steel:		
Ferromanganese	----------	[2] 7,835
Semimanufactures	2,575	NA
Manganese, ore and concentrate	1,226,420	[1] 1,247,838
Uranium, ore and concentrate	1,398	[1] 1,197
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude—thousand 42-gallon barrels	25,068	[1] 28,173
Refinery products—do	102	[2] 667

NA Not available.

[1] Ministere des Mines, de l'Energie et des Ressources Hydrauliques (Gabon). Rapport Annuel (Annual Report). 1968.

[2] United Nations, Statistical Office. World Trade Annual, Supplement. V. 3, 1968.

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Table 3.—Gabon: Imports of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968 [1]
METALS		
Aluminum, metal, including alloys, all forms	58	61
Copper, metal, including alloys, all forms	43	24
Iron and steel:		
Pig iron, ferroalloys and similar materials	------	NA
Semimanufactures	13,920	16,626
Lead, metal, including alloys, all forms	8	NA
Tin, metal, including alloys, all forms, long tons	1	NA
Zinc, metal, including alloys, all forms	8	NA
NONMETALS		
Abrasives, natural, n.e.s	1	NA
Barite	------	2,095
Cement, lime, and dimension stone, worked	39,990	39,725
Clays and clay products	583	508
Fertilizer materials, manufactured	134	NA
Stone, sand and gravel	67	NA
Sulfur, elemental, all forms	1,791	NA
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	------	NA
Gas, hydrocarbon	810	NA
Petroleum refinery products, thousand 42-gallon barrels	642	13
Mineral tar and other coal; petroleum- or gas-derived crude chemicals	3	NA

NA Not available.
[1] United Nations, Statistical Office. World Trade Annual, Supplement. V. 3, 1968.

COMMODITY REVIEW

METALS

Gold.—In the region of N'dangui, disseminated gold deposits were reported in 1969. Apparently the content of gold in situ was not economically exploitable; however, the presence of economic alluvial deposits in the region was not ruled out. By yearend, further study was being considered on the alluvial areas of the N'dangui region.

Iron Ore.—Near yearend, the Gabonese Government signed an agreement with Société des Mines de Fer de Mekambo (SOMIFER), a consortium of United States and European firms, for the exploitation of the Belinga iron deposits. An essential first step toward this goal will be construction of a standard gage railroad. Present plans are for construction of only the first 200 miles of the projected 335-mile railroad. Estimated cost of this segment is $90 million. Financing is to be $20 million from the Gabonese Owendo-Belinga Railroad Investment Fund, $20 million from the French Government, an estimated $20 to $30 million hopefully from the European Economic Community Development Fund, and the remainder is expected to be obtained by securing international financial aid. It was reported that the French loan was granted late in 1969. Once completion of the first segment of the railroad is assured, the Gabonese hope that SOMIFER will assume the major financial burden for completion of the link from Booué to the iron deposits.

Manganese.—The Compagnie Minière de l'Ogooue (COMILOG), a combine of 51 percent French interests and 49 percent United States Steel Corp., increased manganese output to 1.4 million tons from the Moanda ore body. New facilities which were nearing completion are expected to increase annual capacity to 1.8 million tons by the end of 1971. The reserves held by COMILOG are an estimated 125 million tons.

Uranium.—Exploration activities of the only uranium producer, Compagnie des Mines d'Uranium de Franceville (COMUF), led to the discovery of an extension of the deposit now being worked. The French Commissariat à l'Energie Atomique (CEA) continued the search for radioactive minerals in the area of Lambaréné.

NONMETALS

Cement.—The construction of a cement clinker-crushing plant at Owendo was completed near yearend. Operation of the $1.6 million plant will be limited to crushing imported clinker until domestic demand can justify the additional investment required for a completely integrated plant. Present annual capacity is 50,000 tons,

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with storage facilities for 8,000 tons of clinker.

Diamond.—In 1969 Le Bureau de Recherches Geologiques et Minières (BRGM) continued to explore an area near Mitzic where there are known indications of diamonds. No details were reported at yearend. The area near Etéké was found to contain insufficient mineralization to justify exploitation.

Fertilizer Materials.—The Société Gabonaise de Chimie (SOGACHIM) has a $4 million chemical fertilizer plant in the planning stage. Two European companies, sybetra SA (Syndicat Belge d'Entreprise à l'Etranger), Belgium, and Stamicarbon NV, the Netherlands, are to join in the project to be located at Port Gentil.

MINERAL FUELS

Natural Gas.—Marketed natural gas in 1969 was slightly less than the previous year as Gabon continued to utilize only about 10 percent of the gas produced.

Reserves of natural gas at the end of 1968 were reported to be an estimated 500 billion cubic feet.

Petroleum.—Production of crude oil in 1969 increased 8 percent over the previous year. Most of the output was from two fields—Gamba, operated by Shell of Gabon and Anguille operated by Société ELF des Pétroles d'Afrique Equatoriale (ELF-SPAFE)—with 39 percent and 21 percent, respectively.

In mid-1969, an agreement was reached on a price of $1.61 per barrel f.o.b. Port Gentil and Gamba, that the four international companies in France would pay in 1969–70 for Gabonese crude oil purchased from French Government-controlled producers. The price, with no escalation clause for freight, was based on the limited capacity of tankers at Cape Lopez, near Port Gentil, where Mandji crude is loaded. Other factors in the price decision for the two crude oils were the low gravity of the Mandji crude and the waxy quality of the Gamba crude. In addition, the international companies negotiated the right to offtake only 80 percent of their quotas of Gabonese crude oil.

In the development work by ELF-SPAFE, the Anguille and Anguille North-East fields were put into production in July 1969. A new structure containing two oil-bearing zones was located at Baudroie. A 5-year production license was granted to Baudroie Marine, covering about 34 square miles of the Port Gentil and Port Gentil North and South permits.

The Shell/ELF-SPAFE association discovered oil at Estheria Marine 1, which was spudded in August 1969, offshore from Sette Cama. A new well, Ivinga IV 15, in the north part of the Ivinga structure, located oil and may indicate a northward extension of the field. A supplementary development program of the field was underway at yearend. A fifth well in the Port Gentil Ocean permit located oil and may indicate a southward extension of the Anguille North-East field.

Two farmout agreements were signed by ELF-SPAFE during 1969—one with King Resources, a United States firm, and the other with Deminex, a West German firm.

In the agreement with King Resources, the U.S. firm would obtain a 50-percent interest for financing and drilling three exploration wells on the offshore structures of Vairon, Pegase, and Chevesne, located in the southern part of the Port Gentil and Port Gentil North and South permits. The first well, Chevesne Marine I on the Vairon structure, was spudded and capped. A second well, Anguille Nord-Est 4, was spudded and oil traces found.

The agreement with Deminex provides for a share of three permits where preliminary surveys have located promising geological formations. Deminex would have a 25-percent share in the Mac area, located partly on both the Point Gentil North and South permits, and a 30-percent share in the Locke area and a 50-percent share in the Banc du Prince zone, both part of the Port Gentil permit. In return for these shares, Deminex is to finance the drilling of three wells.

Shell was awarded the 203-square-mile Mayumba offshore exploration permit formerly held by ELF-SPAFE whose rights have expired. The permit was granted to Shell for 2 years with a minimum investment obligation of $725,000. Shell would have an 80-percent interest in the venture with ELF-SPAFE retaining 20 percent.

Gabon's reported crude oil reserves at the end of 1968 were an estimated 500 million barrels, only about 1 percent of the total African reserves.

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The Mineral Industry of East Germany

By Joseph B. Huvos [1]

In 1969, East Germany ranked as the leading world producer of brown coal with 34 percent of the world total and ranked fifth in the production of potash with 14 percent. A few other mineral commodities such as salt, iron ore, hard coal and fluorspar were also produced but in less important quantities. No petroleum production was reported. Official statistics are incomplete, with data not reported for a number of mineral commodities. East Germany's mineral processing industries, primarily aluminum, iron and steel, and petroleum refining continued to operate mostly on imported mineral raw materials.

The social product of East Germany increased in 1969 by 7.2 percent, production of the basic industries increased by 4 percent, production of metallic ores, metallurgy, and potash increased by 8 percent.

[1] Foreign mineral specialist, Bureau of Mines, Washington, D.C.

PRODUCTION

Potash mining continued at a high level. A new nitrogen fertilizer complex of the Schwedt-am-Oder type will be built at an undisclosed location. Hard coal production did not change significantly, while brown coal production was slightly lower because of rationalization of the industry. Expansion of the oil tanker fleet was undertaken and plans were made to build new oil and gas pipelines from the U.S.S.R. Construction was started on a second nuclear power station.

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Table 1.—East Germany: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969 [p]
METALS			
Aluminum:			
Alumina	51,353	53,565	NA
Metal, including secondary [e]	80,000	80,000	80,000
Cadmium [e] kilograms	12,000	12,000	12,000
Copper:			
Mine output, metal content	20,000	20,000	[e] 20,000
Metal, including secondary [e]	40,000	40,000	40,000
Iron and steel:			
Iron ore, including pyrite roast thousand tons	1,680	[r] 1,414	[e] 1,400
Pig iron do	2,525	2,333	2,098
Steel, ingots and castings do	[r] 4,592	[r] 4,695	4,824
Semimanufactures	3,075	[r] 3,156	NA
Lead:			
Mine output, metal content [e]	11,000	12,000	12,000
Metal including secondary [e]	25,000	25,000	25,000
Silver, mine output, metal content [e] thousand troy ounces	4,800	4,800	4,800
Tin:			
Mine output, metal content [e] long tons	1,000	1,000	1,000
Metal, including secondary [e] do	1,200	1,200	1,200
Zinc:			
Mine output, metal content [e]	12,000	12,000	12,000
Metal, excluding secondary [e]	14,000	14,000	14,000
NONMETALS			
Barite [e]	30,000	30,000	30,000
Cement thousand tons	7,182	[r] 7,551	[e] 7,600
Fertilizers:			
Potash, K_2O content do	2,206	[r] 2,298	[e] 2,300
Nitrogenous, N_2 content do	336	[r] 351	387
Phosphatic, P_2O_5 content do	305	[r] 346	368
Fluorspar [e]	80,000	80,000	80,000
Gypsum, calcined thousand tons	229	226	[e] 226
Lime, industrial, calcined do	[r] 2,506	[r] 2,584	[e] 2,600
Salt do	[r] 1,833	[r] 1,970	[e] 2,000
Sulfur do	123	[r] 119	[e] 120
Sulfuric acid	99	108	110
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite and bituminous thousand tons	2,789	[e] 2,000	[e] 2,000
Brown and lignite do	242,027	[r] 247,118	[e] 247,000
Coke:			
Bituminous and gas coal, cokes do	2,921	2,551	[e] 2,500
Brown coal cokes do	6,958	6,794	[e] 6,800
Fuel briquets, from brown coal do	56,087	56,389	[e] 56,000
Gas, manufactured million cubic feet	[r] 125,366	136,596	148,066
Petroleum refinery products:			
Gasoline thousand tons	1,852	2,006	NA
Diesel oil, including kerosene do	2,693	2,996	NA
Fuel oils do	2,595	3,127	NA
Lubricants do	312	333	NA
Asphalt do	341	469	NA

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to reported commodities East Germany produced magnesium, gold, nickel, and peat, but level of production is not known.

Source: Compiled from the official Statistical Yearbooks of East Germany and Metal Statistics of 1959–69, Metall-Gesellschaft Aktiengesellschaft, 56th issue, Frankfurt am Main 1969, 308 pp.

TRADE

In 1969, East Germany's limited mineral exports consisted mainly of brown coal briquets, potash, salt, aluminum, fluorspar, and iron and steel manufactures. As in previous years, the U.S.S.R. supplied an important part of the raw and basic materials needed by the key branches of the East German industry, such as crude oil, coke, coal, iron ore, rolled steel, nonferrous metals, and chemical products. Hungary and Yugoslavia provided bauxite.

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Table 2.—East Germany: Exports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968 p
METALS		
Aluminum: [2]		
Metal including alloys:		
Unwrought	7,679	NA
Scrap	2,487	NA
Copper, including alloys, and semimanufactures [2]	382	NA
Iron and steel: [2]		
Pig iron, ferroalloys etc.	451,488	NA
Scrap	44,292	NA
Steel primary forms	17,883	NA
Lead, including alloys: [2]		
Unwrought	4,666	NA
Scrap	358	NA
Tin, including alloys, unwrought—long tons	22	NA
Tungsten, ores and concentrates [2]	NA	NA
Zinc, unwrought, including alloys [2]	NA	NA
NONMETALS		
Kaolin, raw and washed	79,763	73,607
Fertilizers:		
Potash, raw and products, K_2O content—thousand tons	1,540	1,500
Nitrogenous, N_2 content	70,851	NA
Fluorspar	56,000	NA
Gypsum, calcined	59,201	72,961
Salt, rock salt—thousand tons	717	763
Sulfuric acid, monohydrate	8,943	13,018
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	7,659	7,044
Coal, brown coal briquets—thousand tons	3,948	3,957
Coke—do	65	NA
Petroleum refinery products:		
Gasoline—do	500	548
Diesel fuel—do	427	527
Fuel oil—do	232	224
Paraffin—do	60	50

p Preliminary. NA Not available.

[1] Compiled from the official Statistical Yearbooks of East Germany and the Soviet Union, except where noted otherwise.

[2] Statistical Office of the United Nations, 1968 and 1969, supplement to the World Trade Annual. V. 1 East Europe. Walker and Co., New York, 1969, 895 pp. (excludes exports to West Germany).

Table 3.—East Germany: Imports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite	319,038	240,817
Alumina, Al_2O_3 content	50,101	44,491
Metal, including alloys:		
Unwrought	92,500	[2] 84,900
Semimanufactures	14,900	26,800
Cadmium metal, including alloys, all forms [2]	230	185
Chrome ore, Cr_2O_3 content	35,520	29,153
Copper, including alloys, all forms	43,800	[2] 43,800
Iron and steel:		
Iron ore (untreated)—thousand tons	r 1,550	1,424
Metal:		
Scrap [2]—do	206	158
Pig iron—do	617	626
Ferroalloys—do	8,026	6,384
Rod—thousand tons	578	431
Hot rolled strip—do	111	117
Light sheet—do	509	410
Heavy sheet—do	790	910
Cold rolled strip—do	19	29
Lead, including alloys, all forms	44,300	[2] 41,400
Magnesium, including alloys [2]	1,807	1,901
Manganese ore, Mn, content—thousand tons	76	[2] 108
Manganese peroxide	NA	2,600
Zinc, including alloys, all forms	41,200	NA
NONMETALS		
Asbestos	38,340	[2] 34,900
Fertilizers:		
Crude phosphate and apatite concentrate, P_2O_5 content—thousand tons	353	456
Nitrogenous, N_2 content	111,483	156,675
Phosphatic, P_2O_5 content	57,212	40,970
Graphite	5,548	5,761
Kaolin	26,614	29,771
Pyrite, sulfur content	108,890	109,432
Sulfur	NA	NA

See footnotes at end of table.

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Table 3.—East Germany: Imports of selected mineral commodities [1]—Continued
(Metric tons unless otherwise specified)

Commodity		1967	1968
MINERAL FUELS AND RELATED MATERIALS			
Carbon black		r 18,241	21,141
Coal:			
Anthracite [2]	thousand tons	118	r 102
Bituminous	do	8,274	6,284
Brown coal	do	3,782	NA
Coke	do	2,879	2,843
Gas, manufactured	million cubic feet	1,340	2,357
Petroleum:			
Crude	thousand tons	6,440	8,089
Refinery products:			
Gasoline [2]	do	59	NA
Motor gasoline	do	56	32
Diesel fuel [2]	do	32	NA
Lubricants [2]	do	16	NA
Petroleum coke	do	16	NA

r Revised. NA Not available.
[1] If not noted otherwise, data are from the official Statistical Yearbooks of the German Democratic Republic.
[2] Data are from official trade statistics of the U.S.S.R. (imports).

COMMODITY REVIEW

METALS

Aluminum.—In 1969, East Germany produced about 80,000 tons of aluminum, while imports from the U.S.S.R. were 84,900 tons, making 165,000 tons available for domestic processing to satisfy internal demand and exports.

Iron and Steel.—Production of iron ore and pig iron decreased 1 and 10 percent respectively; steel production increased 3 percent. A U.S.S.R. built continuous casting plant of undisclosed capacity was reportedly commissioned at the Riesa tube combine. It was also reported that the Edelstahlwerke at Freital was producing 240,000 tons of alloy steel in 350 types in 1969.

NONMETALS

Nitrogenous Fertilizer.—A plant similar to the Schwedt-am-Oder nitrogen fertilizer complex was planned in East Germany at an undisclosed site. At Schwedt, the plant units reportedly produced 500 tons of ammonia and 1,500 tons of calcium-ammonium-nitrate (25 percent N_2) per day.

Potash.—East Germany first produced potash in 1856. Since then, production has expanded to its present level of about 2.3 million tons of K_2O per year. As demand grew to this level, production was continuously rationalized. While production has increased 24 percent since 1955, the number of operating pits has been reduced from 22 to 15, and the number of employees also reduced. In most mines, reequipment was based on the established scraper techniques, still employed for difficult conditions. Heavy mining equipment such as loading machines, transporters, and special 20-ton-capacity vehicles were being increasingly used.

The Kali-Forschungsinstitut (Potassium Research Institute), the research and development center of the industry, was responsible for rationalizing the mines and manufacturing plants, for developing new processes, and exploring and developing new deposits.

In 1969, East Germany consumed over 600,000 tons K_2O, or about 28 percent of East European potash consumption, compared with 35 percent in 1965. As the use of potash in the rest of East Europe began to increase, East Germany was provided with an expanding export market.

The application rates of potash in East Germany showed a uniform progression from southwest to northwest, increasing from 130 pounds per hectare to about 270 pounds per hectare; the latter was said to be the optimum level of K_2O usage.

MINERAL FUELS

Coal and Lignite.—Hard coal was mined from relatively small coal fields in Saxony, having total reserves of less than 15 million tons. Because production was only 2 million tons per year, imports of 8 to 10 million tons per year were necessary. East Germany's brown coal reserves of Miocene age exceeded 18,000 million tons in 1969.

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They were worked mostly by highly mechanized opencast methods from seams up to 300 feet thick. Large-scale continous overburden excavating equipment was used in conjunction with mobile bridge-conveyors. To date, of the total number of 41 overburden bridge conveyors in operation in the world, 36 are in East German coal mines.[2]

Since 1949, 31 of these units have been built by the VEB Schwermaschinenbau Lauchammerwerk; they are standardized, with clearances of 112, 148, and 197 feet. Bridge conveyor operation has been said to cost one third of conventional overburden moving methods.

In 1969, more coal was used for electric power and for gas manufacturing, and less was used for heating purposes.

Gas.—In 1969, plans were made to start construction in 1970 on a natural gas pipeline in cooperation with the U.S.S.R. to bring Soviet natural gas into the country. In the meantime, it seems that hope has not been abandoned for discovering substantial gas deposits in East Germany. The Soviet Union was assisting with prospecting equipment and material, and exploration was concentrated in the barrier reef area Zechstein 2. Present domestic production was insignificant.

Manufactured gas production was increasing slowly, while efforts continued to switch some gasworks from gas coal to oil.

Nuclear Power.—The Reinsberg nuclear powerplant north of Berlin has been operating at the 70 megawatt level since 1966. Construction started on a second nuclear power station near Greifswald–Bodden, and commissioning of the first section of 800 megawatts was planned for 1974. Final design capacity of the plant is to be 2,000 megawatts. Apparently, Soviet-type VVR2 pressurized water reactors using enriched uranium were planned.

Petroleum.—Throughput at East German oil refineries was 10 million tons in 1969. About 5 million tons of this was processed at the Schwedt refinery; the Leuna-Werke processed 2.8 million tons. Several smaller plants processed the remainder. In the past, emphasis has been on the output of motor fuel; however, lately an increasing proportion of fuel oil has been produced. In 1968, reportedly 38.5 percent of products was fuel oil, compared with 14 percent in 1960. In particular, energy intensive processes such as openhearth furnaces, or glass melting furnaces have been switched from producer gas operation to fuel oil. Some fuel oil operated central heating plants also have been built.

Crude oil imports planned for 1970 were 12.4 million tons and for 1972, 14.1 million tons. Because of the heavy reliance on U.S.S.R. sources, it was decided to lay a 1,200-millimeter-diameter second pipeline from the U.S.S.R. This pipeline is to be commissioned in 1975. The estimated 200,000 dead-weight ton expansion of the tanker fleet in 1969, was also started. In addition to oil imports from the U.S.S.R., Iraqi and United Arab Republic crude have been imported. An $84 million, 2.5-percent-interest 12-year loan was given by East Germany to Iran National Oil Company (INOC), of which up to 70 percent was repayable in Iraqi crude. In 1969, United Arab Republic exported 1.15 million tons of oil to East Germany.

[2] World Mining. V. 5. No. 12, November 1969, pp. 26–31.

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The Mineral Industry of the Federal Republic of Germany

By L. Nahai [1]

The West German economy in 1969 continued its high level of activity which started in the previous year and the gross national product (GNP) estimated at about $164 billion [2] marked a 11.6-percent increase at constant prices. Increases in gross domestic investment (12.8 percent) and in personal consumption (8.0 percent) were the principal factors in the expansion. The continued economic boom increased metal production and consumption, and for many items higher imports were necessary to meet domestic needs.

Total turnover in the mineral industry in 1969 for the various operations shown in table 1 was about 15 percent of the recorded turnover for industry. Average monthly industrial employment totaled 8,310,000, with employment in the mineral industry as indicated in table 1. While employment in industry showed a 5.2-percent increase, (411,000), employment in the mineral industry showed a 1.3-percent decline, to 884,000.

As in the previous year mineral-related Government actions concerned coal and petroleum. Ruhrkohle A. G., the unified coal company for the coal mines of the Ruhr, and the German Oil Supply Company (Deutsche Erdoelversorgungsgesellschaft m.b.H.—Deminex) were formally established during the year and the Government announced relaxation of regional restraints on the sale of imported bituminous coal. The Government also agreed to let the voluntary growth of heavy oil imports to be 7 percent instead of the 4 to 6 percent originally proposed.

With the revaluation of the West German mark on October 26, 1969, the 4-percent tax on exports and a corresponding rebate on imports which were introduced in November 1969 were abandoned. As with the above taxes, the revaluation did not seem to have had a marked influence on the mineral industry.

[1] Special assistant for International Activities, Bureau of Mines, Washington, D.C.

[2] The West German mark was revalued on October 26, 1969, from DM4=US$1.00 to DM3.66=US$1.00. The lower rate of exchange is used for values prior to the revaluation date. The GNP figure has been calculated at the higher rate of DM3.66=US$1.00.

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Table 1.—Federal Republic of Germany: Employment and turnover in the mineral industry

	Average 1969 employment (thousand persons)	Turnover (million dollars) [1]			
		1968		1969	
		Domestic	Foreign	Domestic	Foreign
MINES					
Iron	4	39	------	38	------
Nonferrous metals	3	26	3	26	2
Potash and salt	15	155	55	164	61
Other nonmetallic minerals	2	10	4	10	4
Coal	257	1,317	447	1,433	466
Lignite	26	238	18	251	14
Peat	4	27	4	30	4
Oil and gas	6	206	2	248	3
Total	[2] 318	2,018	528	2,200	554
QUARRIES					
Stone	28	328	4	342	5
Sand and gravel	15	221	11	257	13
Slate, clays, other	7	49	9	54	10
Cement	18	449	14	464	17
Refractories	15	134	33	164	46
Lime, gypsum, chalk	15	202	22	235	18
Limestone, sandstone	5	108	------	111	------
Pumice	7	107	1	113	1
Total	110	1,598	94	1,740	110
PROCESSING PLANTS					
Iron and steel	328	4,377	1,299	5,526	1,720
Nonferrous plants	89	1,622	375	2,068	395
Petroleum refineries	35	4,406	150	4,670	181
Coal chemicals	4	74	19	72	23
Total	456	10,479	1,843	12,336	2,319
Grand total	[2] 884	14,095	2,465	16,276	2,983

[1] Values have been converted from West German marks to U.S. dollars at the rate of DM4 = US$1.00 for 1968 and DM3.66 = US$1.00 for 1969.
[2] Data may not add to totals shown because of independent rounding.

PRODUCTION

The index of industrial production rose again in 1969. The increase of 12.5 percent to 147.6 (1962 = 100) was higher than in 1968 (11.7 percent). For mining, the increase was more modest. The index for metal mining declined, but for petroleum and natural gas, iron and steel, and nonferrous metals the increase was higher than for the industrial average.

Industry sector	Index of production (1962 = 100)		Change (percent)
	1968	1969	
Mining	r 93.4	96.6	3.4
Coal	85.2	86.5	1.5
Metal ores:			
Iron	48.3	46.8	−3.1
Other	r 121.3	117.6	−3.1
Potash and salt	129.7	137.2	5.8
Crude oil and gas	171.2	195.8	14.4
Iron and steel	128.8	145.2	12.7
Nonferrous metals	r 141.5	159.6	12.8
Petroleum refined	190.3	199.7	4.9
Stone and sand industries	r 120.0	125.9	4.9

r Revised.

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Table 2.—Federal Republic of Germany: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
METALS				
Aluminum:				
Bauxite, gross weight		2,284	3,349	NA
Alumina, gross weight	thousand tons	741	742	782
Metal:				
Primary	do	253	257	263
Secondary:				
Unalloyed	do	21	28	34
Alloyed	do	165	204	264
Semimanufactures	do	381	475	563
Crude castings	do	145	183	223
Bismuth		NA	e 150	NA
Cadmium		399	342	792
Cobalt		883	809	750
Copper:				
Mine output, metal content		1,190	1,338	1,444
Metal:				
Blister:				
Primary	thousand tons	73	96	93
Secondary	do	r 76	96	92
Refined, including secondary:				
Electrolytic	do	267	304	303
Fire, refined	do	r 89	103	100
Alloys	do	31	36	41
Semimanufactures	do	685	794	926
Castings	do	71	86	96
Gold (smelter)	thousand troy ounces	74	85	NA
Iron and steel:				
Iron ore and concentrate	thousand tons	r 6,786	r 6,447	6,061
Pig iron	do	27,112	29,977	33,526
Blast furnace, ferromanganese, and spiegeleisen	do	254	328	238
Steel ingots and castings	do	36,744	41,159	45,316
Of which castings	do	526	633	717
Steel semimanufactures	do	24,922	28,697	32,247
Lead:				
Mine output, metal content	do	59	52	39
Metal, unalloyed:				
Primary	do	136	120	126
Secondary	do	153	153	179
Alloys, unwrought	do	19	26	43
Semimanufactures and castings	do	56	56	59
Magnesium metal and alloys, including secondary:				
Unwrought		2,236	2,560	2,130
Castings		r 28,762	37,769	40,122
Mercury	76-pound flasks	NA	2,350	NA
Molybdenum		162	220	NA
Nickel, including secondary [1]		300	NA	NA
Platinum	troy ounces	9,932	9,600	NA
Silver:				
Mine output, metal content	thousand troy ounces	r 2,022	r 1,769	1,686
Metal, including secondary	do	16,480	21,918	27,066
Tin metal, including secondary:				
Refined unwrought	long tons	2,590	2,475	2,415
Alloys, unwrought and solder	do	21,716	r 24,886	26,050
Tungsten		518	798	819
Zinc:				
In zinc ore	thousand tons	107	110	111
In pyrite	do	8	7	6
Metal, unwrought, unalloyed:				
Primary	do	103	122	218
Secondary	do	84	81	61
Alloys	do	61	79	92
Semimanufactures	do	74	73	75
Castings	do	40	54	62
NONMETALS				
Barite (marketable)	thousand tons	410	r 431	437
Bromine, fluorine, and iodine		2,810	2,500	3,625
Cement:				
Portland	thousand tons	23,662	25,319	26,979
Iron portland and blast furnace slag	do	7,004	7,222	7,207
Other cement and mortar	do	841	902	892
Chalk	do	108	86	NA
Clays:				
Fire clay (exclusive of Klebsand)	do	3,700	3,933	NA
Kaolin (marketable)	do	404	r 468	436
Bleaching	do	369	429	NA
Other (Schieferton)	do	67	68	NA
Corundum, artificial	do	71	78	103
Diatomaceous and similar earths	do	90	r 92	114
Feldspar	do	266	r 288	NA

See footnotes at end of table.

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Table 2.—Federal Republic of Germany: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
NONMETALS—Continued				
Fertilizers:				
Potash:				
Crude (gross weight)	thousand tons	19,850	20,187	20,310
Crude, K_2O content	do	2,460	2,561	2,626
Marketable, K_2O content:				
Crude	do	33	34	NA
Chemically processed	do	2,097	2,186	2,283
Manufactured fertilizers:				
Nitrogenous:				
Single	do	1,153	1,170	1,172
Mixed	do	410	397	422
Phosphatic, P_2O_5 content:				
Single	do	561	501	482
Of which Thomas slag	do	381	340	302
Mixed	do	413	404	429
Fluorspar	do	r 87	r 88	92
Graphite	do	12	13	NA
Gypsum (inclusive of anhydrite)	do	r 1,241	1,478	1,360
Lime:				
Burnt, hydraulic, and burnt dolomite	do	10,142	10,634	10,667
Other, ground	do	3,083	3,718	3,844
Pigments, natural mineral	do	9	15	NA
Pumice:				
Crude and washed	do	7,898	6,712	7,149
Marketable	do	r 4,186	3,562	4,001
Pyrite, marketable:				
Gross weight	do	556	r 617	641
Sulfur content	do	235	259	266
Quartz, quartzite, glass sand:				
Quartzite	do	210	230	NA
Quartz sand (ground)	do	733	938	1,080
Quartz sand (unground) and glass sand	do	4,806	4,947	5,586
Salt:				
Rock (marketable)	do	5,165	r 6,125	8,358
Other (marketable)	do	1,742	1,929	
Stone, sand and gravel, n.e.s.:				
Dimension stone	thousand cubic meters	241	219	NA
Limestone, industrial	thousand tons	52,380	54,391	59,623
Crushed and broken	do	90,847	99,500	103,496
Slate: [2]				
Roofing for office and industry	do	30	28	28
Splittings and ground	do	76	77	82
Basalt lava and lava sand	do	r 5,778	6,843	NA
Calcite	do	35	31	NA
Grinding and whetstone	cubic meters	270	271	278
Printing stone	thousand cubic meters	40	33	37
Trass and tuff	thousand tons	3	NA	NA
Industrial sands:				
Molding sand	do	761	1,021	1,122
Other (Klebsand)	do	129		
Sand and gravel	do	161,335	176,879	186,002
Sulfur, elemental byproduct	do	105	127	128
Talc, including talc schist	do	33	r 28	NA
MINERAL FUELS AND RELATED MATERIALS				
Carbon black		135	178	210
Coal, bituminous and anthracite	thousand tons	112,043	112,012	111,630
Coal briquets	do	3,578	3,693	3,907
Lignite	do	96,766	101,516	107,424
Lignite briquets	do	11,063	10,357	10,499
Pech coal	do	890	834	763
Coke:				
At mines	do	30,652	31,872	33,324
At steelworks	do	r 4,520	4,295	5,686
At gasworks	do	2,869	r 2,327	2,406
From lignite	do	394	------	------
Gas: [3]				
Natural (associated and unassociated), refinery, and gas from oil, tar, and naphtha	million cubic meters	27,342	35,994	NA
Blast furnace gas	do	12,807	13,557	NA
Generator and water gas	do	1,692	1,170	NA
Coke oven gas	do	17,692	17,918	NA
Other	do	734	792	NA
Total	do	60,267	69,431	NA

See footnotes at end of table.

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Table 2.—Federal Republic of Germany: Production of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
MINERAL FUELS AND RELATED MATERIALS—Continued				
Natural gas:				
Nonassociated (1,000 cubic meters not converted to standard calorific value)		8,713,763	5,785,767	8,187,296
Associated	do	624,280	609,821	725,000
Petroleum:				
Crude	thousand tons	7,927	7,982	7,876
Refinery products:				
Liquefied petroleum gas	do	1,743	1,822	2,586
Motor gasoline	do	10,743	11,474	11,528
Naphtha	do	2,660	4,396	4,945
Other gasolines	do	212	240	237
Jet fuel and kerosine	do	1,002	1,185	1,367
Diesel oil	do	8,321	9,173	8,965
Fuel oil [4]	do	44,711	50,402	54,886
Lubricants	do	668	827	923
Bitumen	do	3,814	4,344	4,499
Petroleum coke	do	454	572	575
Refinery gas	do	3,684	4,335	4,122
Other	do	759	890	1,333
Total	do	78,771	89,660	95,966

e Estimate. p Preliminary. r Revised. NA Not available.
[1] Primary nickel and nickel contained in ferronickel, monel metal and nickel oxide directly used by the steel industry.
[2] Exclusive of slate recovered from mine dumps.
[3] All volumes converted to 4,300 kilocalories per cubic meter.
[4] Includes distillates used as heating oil.

TRADE

Details on total tonnage by commodities, principal sources, and destinations appear in tables 3 and 4.

Table 3.—Federal Republic of Germany: Exports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum:			
Bauxite	2,526	2,187	Austria 1,008; Belgium-Luxembourg 704.
Alumina	113,790	86,562	Austria 73,049; Rumania 3,617; Italy 1,296.
Aluminum hydroxide	42,871	48,317	Netherlands 12,877; Belgium-Luxembourg 9,349; Austria 6,117.
Metals and alloys:			
Scrap	10,662	7,785	Italy 3,827; Netherlands 3,176; France 665.
Unwrought	21,802	23,140	France 5,849; Netherlands 4,688; Italy 4,635.
Semimanufactures	96,202	118,353	France 31,209; Netherlands 18,745; Belgium-Luxembourg 12,901; United States 9,573.
Antimony, metal	189	119	France 50; Netherlands 26.
Bismuth, metal	128	81	Poland 35; France 33.
Cadmium, metal, all forms	147	69	France 21; Belgium-Luxembourg 9.
Chromium:			
Chromite	1,404	1,316	Netherlands 464; Austria 419.
Oxides and hydroxides	6,748	6,507	NA.
Metal	99	19	Italy 6; Netherlands 5.
Cobalt metal, including alloys, all forms	192	181	Japan 86; Spain 37; United States 14.
Columbium metal, including alloys, all forms kilograms	1,682	2,113	United Kingdom 1,043; Japan 234.
Copper:			
Ore and matte	1,387	7,519	Belgium-Luxembourg 7,517.
Metal and alloys:			
Scrap	35,340	31,722	Italy 11,507; Belgium-Luxembourg 7,467; Netherlands 3,355.
Blister	8,840	11,541	Belgium-Luxembourg 7,855; Netherlands 2,118.
Refined, unalloyed	158,587	139,050	United States 32,103; United Kingdom 19,599; mainland China 14,929.
Master alloys	165	736	Belgium-Luxembourg 613; France 65.
Other alloys	2,813	2,077	Switzerland 505; Austria 414; Italy 366; France 288.
Semimanufactures	99,775	92,735	United States 25,845; Netherlands 15,010; Czechoslovakia 6,220.

See footnote at end of table.

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Table 3.—Federal Republic of Germany: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS—Continued			
Gold and alloys:			
Bullion....thousand troy ounces..	358	802	Switzerland 242; Indonesia 135; Italy 75.
Wrought....do....	201	151	France 42; Denmark 26; Canada 26.
Iron and steel:			
Ore and concentrates:			
Roasted pyrite....thousand tons..	51	22	Austria 17; Belgium-Luxembourg 3.
Other....do....	332	18	Belgium-Luxembourg 7; Austria 3; Netherlands 2.
Scrap....do....	2,170	1,846	Italy 1,742; Belgium-Luxembourg 30; France 30.
Pig iron....do....	1,296	815	Italy 367; United States 97; Japan 64.
Sponge iron, powder and shot...do....	9	11	Netherlands 2; Switzerland 2; Austria 1.
Spiegeleisen....do....	12	14	Belgium-Luxembourg 11; Austria 1.
Ferroalloys:			
Ferromanganese....do....	40	75	United States 44; France 9; Switzerland 5; Italy 3.
Other....do....	80	89	United States 9; Belgium-Luxembourg 4; Netherlands 3; Italy 3.
Steels, primary forms:			
Ingots....do....	124	127	France 79; Italy 17; Netherlands 16.
Blooms, billets and slabs...do....	1,285	1,041	France 332; Spain 158; Italy 127.
Coils for rerolling....do....	1,276	1,410	United States 642; Italy 193; France 180; Netherlands 154; Belgium-Luxembourg 107.
Semimanufactures:			
Bars, rods, angles, shapes, and sections:			
Wire rod....thousand tons..	595	753	United States 267; France 121; Netherlands 58; Sweden 45.
Other bars and rods...do....	1,402	1,328	France 416; United States 238; Netherlands 159; Denmark 49.
Sections....do....	1,374	1,392	United States 301; France 254; Netherlands 214.
Plates and sheets:			
Heavy....do....	1,482	1,507	France 329; Netherlands 169; United States 168.
Medium....do....	163	133	France 17; mainland China 15; Netherlands 15.
Thin, uncoated....do....	1,382	1,916	United States 702; U.S.S.R. 263; Czechoslovakia 122.
Tinned....do....	185	180	France 19; Spain 16; Netherlands 14; Portugal 11.
Other coated....do....	286	396	United States 237; Italy 21; mainland China 18; Netherlands 17.
Hoop and strip....do....	502	509	Netherlands 131; France 85; Switzerland 36.
Rails and accessories....do....	141	139	Italy 35; Netherlands 24; Switzerland 15.
Wire....do....	237	255	France 46; United States 38; Netherlands 26.
Tubes, pipes, and fittings...do....	1,558	1,728	Netherlands 313; United States 190; U.S.S.R. 133; France 127.
Castings and forgings, rough do....	82	85	Netherlands 6; Liberia 5; Switzerland 4.
Lead:			
Ore and concentrates....	5,637	5,398	Belgium-Luxembourg 4,823; France 565.
Oxides....	7,486	7,486	Netherlands 2,311; United States 947; France 603.
Metal:			
Scrap....	20,172	10,164	Italy 4,297; Belgium-Luxembourg 3,136.
Unwrought....	80,350	44,282	United States 17,245; France 6,940; Belgium-Luxembourg 5,971.
Semimanufactures....	7,183	8,310	Belgium-Luxembourg 1,008; Switzerland 810; Finland 742; Iran 638.
Magnesium:			
Oxides and hydroxides....	1,988	2,031	Italy 467; Austria 272; Czechoslovakia 122; Sweden 120.
Metal:			
Scrap....	259	906	Italy 403; United Kingdom 216; Norway 208.
Unwrought and semimanufactures.	177	393	Austria 116; Sweden 49; Netherlands 32.
Manganese:			
Ore....	611	3,772	France 3,270.
Oxides....	280	194	Belgium-Luxembourg 167.
Metal, including alloys, all forms....	12	32	NA.
Mercury, metal....76-pound flasks..	1,149	972	Switzerland 162; United States 151; Netherlands 128.
Molybdenum, metal....	80	113	France 33; Netherlands 26; United States 23.

See footnote at end of table.

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Table 3.—Federal Republic of Germany: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS—Continued			
Nickel:			
Matte and speiss	223	6	NA.
Metal and alloys:			
Scrap	2,327	1,404	United Kingdom 663; Netherlands 449; Belgium-Luxembourg 86.
Unwrought	510	1,053	Italy 504; Netherlands 202; Norway 136.
Semimanufactures	6,727	6,806	Netherlands 1,356; France 633; Italy 582.
Platinum-group metals, all forms thousand troy ounces	391	462	Mainland China 68; Japan 57; Netherlands 39.
Silicon	40	121	Netherlands 63; France 40.
Silver:			
Ashes kilograms	8,181	9,637	Belgium-Luxembourg 9,489.
Metal and alloys:			
Unwrought thousand troy ounces	13,579	23,980	Switzerland 8,170; Italy 6,125; United Kingdom 2,828.
Semimanufactures do	9,902	11,120	Sweden 1,987; Switzerland 1,717; Italy 1,303.
Tantalum metal, all forms kilograms	13,542	6,177	United Kingdom 1,789; Austria 1,511; Finland 976.
Tin:			
Ore long tons	46	42	United Kingdom 16.
Metal alloys:			
Scrap do	81	47	Netherlands 38; United Kingdom 6.
Unwrought do	1,995	1,512	France 741; Netherlands 340.
Semimanufactures do	199	249	Netherlands 34; Norway 28; Iran 21; Italy 18.
Titanium:			
Ores (ilmenite and rutile) thousand tons	165	692	France 216; Switzerland 193; Yugoslavia 171.
Metal	363	115	United Kingdom 31; Austria 28; France 27.
Tungsten:			
Ore	178	123	Czechoslovakia 75; United Kingdom 37; France 10.
Metal, all forms	338	730	Switzerland 94; Austria 65; United States 44.
Vanadium metal, including alloys, all forms kilograms	-------	3,500	Austria 3,000; United States 500.
Zinc:			
Ore	90,395	116,842	Belgium-Luxembourg 38,988; France 27,822; Poland 16,641.
Metal, including alloys:			
Scrap	4,719	5,682	Italy 2,972; France 1,451; Netherlands 1,026.
Zinc dust	2,858	3,675	Netherlands 1,951; Belgium-Luxembourg 1,073.
Unwrought	28,614	37,791	United Kingdom 8,057; Switzerland 5,577.
Semimanufactures	6,672	8,316	France 1,926; Netherlands 750; Sweden 713.
Zirconium metal, all forms	15	17	Sweden 13; Italy 2.
Other:			
Metalliferous nonferrous waste, n.e.s.	128,536	145,926	Belgium-Luxembourg 61,802; Netherlands 42,804.
Oxides and hydroxides of barium and strontium	1,315	1,500	France 481; United Kingdom 331.
Metals and metalloids:			
Alkali, alkaline earth, rare-earth metals	5,705	12	Japan 4.
Arsenic and tellurium	8	7	Netherlands 2.
Boron nitrogen	r 3,889	1,907	Switzerland 1,487; Netherlands 244.
Selenium and phosphorus	8,415	8,211	NA.
Uranium and thorium kilograms	100	600	Switzerland 200.
Ferrocerium and pyrophoric alloys	97	169	NA.
Other	3	2	Japan 1.
NONMETALS			
Abrasives:			
Natural:			
Pumice, emery, and other natural abrasives thousand tons	560	516	Netherlands 367; Belgium-Luxembourg 142.
Industrial diamond thousand carats	165	205	Mainland China 90; Netherlands 50.
Dust and powder of gem stones, including synthetic stones thousand carats	71	189	Netherlands 86; Switzerland 58.
Manufactured (grinding stones)	6,014	8,577	France 1,028; Italy 928; Netherlands 831.
Artificial:			
Corundum	27,299	28,343	Sweden 3,378; Austria 3,158; United Kingdom 2,979; Italy 2,290.
Silicon carbide	7,423	8,156	NA.

See footnote at end of table.

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Table 3.—Federal Republic of Germany: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
NONMETALS—Continued			
Boron materials:			
Crude	214	1,325	Sweden 988; France 16.
Boric oxide and acid	51	116	Yugoslavia 87.
Cement, portland, hydraulic, and other types thousand tons	1,236	1,384	Netherlands 1,101.
Chalk, crude	7,523	5,378	Netherlands 2,798; Denmark 1,087.
Clays and clay products:			
Crude:			
Kaolin thousand tons	76	77	Italy 28; Austria 15; Belgium-Luxembourg 9.
Fire clay do	333	355	Netherlands 93; Italy 77; France 58.
Andalusite, dinas, and others do	388	668	Netherlands 351; Belgium-Luxembourg 115; Italy 86.
Products, construction materials:			
Refractory do	289	250	Belgium-Luxembourg 48; France 42; Italy 18; Netherlands 16.
Nonrefractory do	345	409	France 161; Netherlands 95; Austria 55; Belgium-Luxembourg 32.
Diamonds and other gem stones:			
Diamond, except powder, dust, crude or rough cut thousand carats	45	40	NA.
Other, worked do	120	85	Belgium-Luxembourg 45; Netherlands 20.
Other precious or semiprecious stones:			
Crude or rough cut kilograms	54,779	72,891	Japan 18,172; France 11,546, Italy 9,914.
Worked do	25,718	23,706	United States 9,402; France 2,209.
Diatomite and other infusorial earths	3,616	5,314	Austria 839; Italy 764; Saudi Arabia 697.
Feldspar	12,082	12,918	Netherlands 5,489; Belgium-Luxembourg 2,774; France 2,053.
Fertilizer materials:			
Crude, natural:			
Phosphatic	50,069	23,724	Austria 21,352.
Potassic	53,075	50,314	Netherlands 22,803; Belgium-Luxembourg 21,450.
Organic, including guano	3,406	5,586	Netherlands 5,075; Switzerland 139.
Manufactured:			
Nitrogenous thousand tons	1,594	1,636	Mainland China 132; United Kingdom 98; Belgium-Luxembourg 89; India 58.
Phosphatic:			
Basic slag do	203	215	France 144; Austria 38; Netherlands 16.
Other do	11	42	Cuba 6; Turkey 6; India 1.
Potassic do	1,623	1,960	Poland 292; Belgium-Luxembourg 213; Netherlands 138; United States 134; Denmark 128.
Mixed do	761	933	France 168; Turkey 74; Belgium-Luxembourg 64; Spain 63; Yugoslavia 63.
Ammonia, anhydrous do	27	135	Belgium-Luxembourg 56; United Kingdom 16.
Fluorspar	9,403	9,341	Austria 5,184; Belgium-Luxembourg 918.
Graphite, natural, crude or ground	7,675	8,034	Italy 2,563; United States 1,674.
Gypsum and plasters thousand tons	296	301	Netherlands 148; Belgium-Luxembourg 48; Switzerland 30.
Lime, hydraulic and slaked do	356	410	Netherlands 341; France 30.
Magnesite	8,963	9,679	France 4,008; Belgium-Luxembourg 1,736; Austria 627.
Mica:			
Crude, including splitting and waste	130	66	France 1.
Worked, including agglomerate splittings	553	589	Switzerland 288; Iran 114.
Pigments:			
Earth colors, natural	6,269	9,178	Netherlands 3,664; Belgium-Luxembourg 852.
Iron oxides and hydroxides thousand tons	87	95	United Kingdom 15; France 14; United States 10.
Pyrite (gross weight)	176	147	France 71; Austria 15.
Salt thousand tons	1,014	1,169	Belgium-Luxembourg 572; Sweden 264; Denmark 130.
Sodium and potassium compounds, n.e.s.:			
Caustic soda thousand tons	263	238	Netherlands 65; Brazil 26; Belgium-Luxembourg 20.
Caustic potash, sodium and potassium peroxides	10,755	10,488	U.S.S.R. 2,500; United States 1,330; Sweden 1,066.

See footnote at end of table.

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Table 3.—Federal Republic of Germany: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
NONMETALS—Continued			
Stone, sand and gravel, n.e.s.:			
Dimension stone:			
Unworked and partly worked:			
Marble and other calcareous, thousand tons	3	4	Belgium-Luxembourg 1.
Slate, do	21	28	Netherlands 11; Belgium-Luxembourg 4.
Granite, porphyry, other, do	395	583	Netherlands 560.
Worked, all types, including paving blocks, do	46	40	Netherlands 24; Belgium-Luxembourg 9.
Dolomite, chiefly refractory grade, do	86	74	Netherlands 39; France 18; Belgium-Luxembourg 9.
Gravel and crushed rock, macadam, do	10,621	10,652	Netherlands 8,291; Belgium-Luxembourg 1,270; Switzerland 948.
Limestone, except dimension, do	74	74	Netherlands 67.
Quartz and quartzite, crude and partly worked, do	39	47	Austria 14; Italy 9; Belgium-Luxembourg 7.
Sand, excluding metal bearing, do	5,432	6,403	Netherlands 5,232; Belgium-Luxembourg 714.
Sulfur:			
Elemental, including colloidal and precipitated	74,182	45,898	Austria 18,848; Netherlands 5,934; Thailand 2,056.
Other elemental	1,282	2,077	United Kingdom 576; India 248; Sweden 154.
Sulfur dioxide	11,839	13,280	Belgium-Luxembourg 7,511; Sweden 2,348; Netherlands 2,190.
Sulfuric acid	61,037	147,259	Belgium-Luxembourg 96,455; Netherlands 19,588; United Kingdom 14,047.
Talc, soapstone, steatite	1,540	4,054	Denmark 1,678; Netherlands 729.
Vermiculite, chlorite, and perlite	107	184	Sweden 139.
Other nonmetallic:			
Bromine, fluorine	120	155	Netherlands 102; France 13.
Slag dross and similar waste, not metal bearing:			
From iron and steel manufactures, thousand tons	867	1,412	Netherlands 1,055; France 291.
Other, do	165	203	Netherlands 152; France 43.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,851	1,553	Belgium-Luxembourg 598; Austria 568.
Coal, coke, briquets:			
Anthracite and bituminous coal, thousand tons	17,448	20,249	France 6,083; Netherlands 4,788; Belgium-Luxembourg 3,661.
Bituminous coal briquets, do	172	159	Italy 48; France 45; Belgium-Luxembourg 27.
Lignite and lignite briquets, do	1,158	1,058	France 337; Austria 185; Italy 150; Belgium-Luxembourg 150.
Peat and peat briquets, do	216	201	Netherlands 78; Switzerland 38; United States 18.
Coke and semicoke from coal, peat, and lignite, do	7,635	9,273	Belgium-Luxembourg 3,425; France 2,885; Sweden 662.
Carbon black	36,402	46,528	Netherlands 8,466; France 7,293; Belgium-Luxembourg 5,889.
Gas, natural and manufactured, thousand tons	333	344	Netherlands 86; France 81; Denmark 62.
Hydrogen and rare gases	1,793	4,282	NA.
Petroleum:			
Crude and partly refined, thousand tons	82	32	Austria 32.
Refinery products:			
Gasoline, do	1,114	1,697	United Kingdom 660; Switzerland 361; Netherlands 217.
Kerosine, do	622	704	Bunkers 634; Netherlands 32; Switzerland 14.
Distillate fuel oil, do	1,895	1,588	Switzerland 910; Bunkers 292; Netherlands 123.
Residual fuel oil, do	3,956	4,496	Netherlands 1,439; Bunkers 1,319; Austria 557.
Lubricants, do	211	292	Belgium-Luxembourg 56; Italy 46; United Kingdom 41.
Mineral jelly and wax, do	69	81	Italy 10; Denmark 6; Austria 5.

See footnote at end of table.

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Table 3.—Federal Republic of Germany: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum—Continued			
Refinery products—Continued			
Other:			
Nonlubricating oils, n.e.s thousand tons	167	170	United Kingdom 72; Belgium-Luxembourg 35; Switzerland 28.
Pitch and pitch coke do	271	261	France 158; Spain 25.
Petroleum coke do	151	187	Netherlands 52; Norway 38.
Bitumen and other residues do	262	335	Switzerland 115; Netherlands 62; Denmark 58.
Bituminous and other mixtures do	32	31	Denmark 12; Netherlands 6.
Mineral tar and other coal, petroleum and gas derived chemicals do	249	372	Netherlands 115; United Kingdom 79.

r Revised. NA Not available.

Table 4.—Federal Republic of Germany: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum:			
Bauxite thousand tons	1,802	1,978	Yugoslavia 600; Australia 400; Sierra Leone 327; Greece 327.
Alumina	65,523	48,474	Guinea 43,371; Surinam 2,715.
Aluminum hydroxide	1,690	1,629	United States 1,503.
Metal, including alloys:			
Scrap	49,719	67,091	United States 17,111; France 5,566; Netherlands 5,102.
Ingots	185,381	292,225	Norway 96,209; France 45,676; Austria 21,781; Italy 19,533.
Semimanufactures	38,755	69,282	France 19,003; Belgium-Luxembourg 16,721; Netherlands 11,287.
Antimony:			
Ore and concentrate	3,024	3,876	Turkey 1,095; Bolivia 982; Thailand 584.
Metal, all forms	2,402	1,442	Mainland China 507; Belgium-Luxembourg 479; Czechoslovakia 322.
Arsenic, hydroxides	1,075	1,023	Belgium-Luxembourg 637; France 295.
Bismuth, metal, all forms	250	150	Japan 44; Yugoslavia 34; Netherlands 27.
Cadmium, metal, all forms	1,189	1,526	Belgium-Luxembourg 550; Japan 289; U.S.S.R. 176.
Chromium:			
Chromite	284,660	361,829	Republic of South Africa 156,440; U.S.S.R. 118,721; Turkey 58,488.
Oxides and hydroxides	159	265	U.S.S.R. 242.
Metal, all forms kilograms	90,600	286,700	United Kingdom 83,600; France 50,000; Japan 44,000.
Cobalt metal, including alloys, all forms	571	1,183	United States 334; Belgium-Luxembourg 287; Congo (Kinshasa) 251.
Copper:			
Ore and concentrate	132,342	206,112	Chile 58,746; United States 50,194; Cyprus 39,252.
Matte	356	1,208	Sweden 966; United Kingdom 168.
Metal, including alloys:			
Scrap	83,337	110,624	Canada 23,491; Netherlands 16,170; France 13,797; United States 13,089.
Unwrought:			
Blister	164,767	146,384	Republic of South Africa 42,837; Gambia 33,740; Chile 20,428; Peru 17,660.
Refined	272,208	323,841	Chile 96,783; Belgium-Luxembourg 57,890; Zambia 49,973.
Alloys	42,645	52,788	United Kingdom 22,138; Netherlands 4,978; Rumania 2,430.
Masteralloys	849	1,169	United Kingdom 505; Switzerland 344.
Semimanufactures	33,448	57,196	Belgium-Luxembourg 20,460; Netherlands 8,017; France 7,898.
Gold:			
Ashes, residues and scrap thousand troy ounces	1,714	2,002	Switzerland 1,730; Denmark 164.
Metal:			
Unwrought do	5,526	4,195	United States 1,646; Republic of South Africa 972; Switzerland 881.
Semimanufactures do	17	36	Switzerland 10; United States 5; Austria 3.

See footnote at end of table.

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Table 4.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS—Continued			
Iron and steel:			
Ore and concentrate:			
Iron ore—thousand tons	31,861	39,644	Sweden 12,889; Liberia 6,978; Brazil 4,730; France 4,507.
Roasted pyrites—do	1,618	1,789	Spain 697; Belgium-Luxembourg 275; Italy 274.
Metal:			
Spiegeleisen—do	8	3	France 2.
Pig iron, including cast iron—do	139	199	Canada 33; Norway 25; Belgium-Luxembourg 25; France 23.
Powder and shot—do	17	19	Sweden 8; France 6.
Ferroalloys:			
Ferromanganese—do	73	111	Norway 42; France 38.
Other—do	182	262	Norway 110; Republic of South Africa 27; United States 26; France 24.
Scrap—do	1,103	1,644	Netherlands 600; Belgium-Luxembourg 424; United Kingdom 249.
Steel, primary forms:			
Ingots—thousand tons	74	117	Netherlands 54; Poland 53.
Blooms, billets and slabs—do	290	538	Belgium-Luxembourg 256; Netherlands 177.
Coil for rerolling—do	624	789	Austria 356; U.S.S.R. 177; Belgium-Luxembourg 137.
Semimanufactures:			
Wire rod—do	597	843	Belgium-Luxembourg 385; France 279; Netherlands 71.
Other bars and rods—do	699	1,171	Belgium-Luxembourg 587; Italy 236; France 145.
Sections:			
Large—do	328	489	Belgium-Luxembourg 322; France 127.
Small—do	203	296	Belgium-Luxembourg 191; France 44; Italy 13.
Plates and sheets:			
Heavy—do	506	1,002	Belgium-Luxembourg 466; France 103.
Medium—do	161	226	Belgium-Luxembourg 143; France 35.
Thin, uncoated—do	1,172	1,462	Belgium-Luxembourg 566; France 480; Netherlands 194.
Coated:			
Tinned—do	103	119	France 60; Belgium-Luxembourg 43.
Other—do	92	109	Belgium-Luxembourg 49; France 29.
Hoop and strip—do	309	467	Belgium-Luxembourg 289; France 69; Netherlands 67.
Railway track material—do	10	16	Netherlands 7; Belgium-Luxembourg 5; France 1.
Wire—do	70	93	Belgium-Luxembourg 56; France 10.
Tubes, pipes, and fittings—do	125	228	Netherlands 81; Belgium-Luxembourg 54.
Lead:			
Ore and concentrate	223,212	249,914	Canada 88,212; Sweden 42,964; Ireland 39,203.
Metal and alloys:			
Scrap	2,622	8,985	Netherlands 3,399; France 2,049; Belgium-Luxembourg 1,847.
Unwrought	81,473	90,857	United Kingdom 32,893; Canada 12,005; Australia 11,653.
Semimanufactures	2,009	2,042	NA.
Magnesium:			
Oxide and hydroxide	1,713	2,976	Norway 903; United States 833; France 638.
Scrap	676	586	Netherlands 173; Sweden 81.
Unwrought	32,106	41,261	Norway 19,370; Canada 6,585; Italy 5,744.
Semimanufactures	138	111	Austria 44; United States 13.
Manganese:			
Ores and concentrates—thousand tons	672	620	Gabon 180; Republic of South Africa 167; Brazil 100.
Metal, all forms	2,658	4,292	France 1,295; Republic of South Africa 848; Japan 724.
Mercury, metal—76-pound flasks	12,442	15,133	Spain 8,491; Italy 2,750; Mexico 1,323.
Molybdenum; metal	250	226	Austria 111; U.S.S.R. 42; Netherlands 36.
Nickel:			
Ore and concentrate	243	-----	
Matte and speiss	4,042	2,596	Canada 2,400; United States 101.
Metal and alloys:			
Scrap	6,590	8,719	United States 4,004; Netherlands 1,077; Canada 986.
Unwrought	28,255	31,360	United Kingdom 11,334; Norway 4,815; U.S.S.R. 4,756.
Semimanufactures	1,907	2,188	United Kingdom 916; France 409; United States 332.

See footnote at end of table.

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Table 4.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS—Continued			
Platinum-group metals:			
Ashes, residues, and scrap thousand troy ounces	2,381	3,177	France 1,863; Netherlands 367; Czechoslovakia 301; Switzerland 270.
Metal, all forms do	492	688	U.S.S.R. 205; United Kingdom 144; United States 117.
Silicon	15,987	23,799	France 7,501; Norway 6,291; Italy 3,821.
Silver:			
Ashes, residues, and scrap thousand troy ounces	7,017	15,434	United States 7,574; Sweden 2,624; Norway 1,462.
Unwrought do	47,721	59,991	Mexico 12,775; Muscat Oman 12,087; United Kingdom 8,338.
Semimanufactures do	671	899	Switzerland 626; Italy 159.
Tantalum, metal, all forms kilograms	9,000	26,547	United States 16,599; United Kingdom 1,834; Switzerland 1,805.
Thorium, uranium, and rare earths compounds	484	408	United States 130; France 85.
Tin:			
Ore and concentrate long tons	8,250	7,989	Bolivia 7,856.
Oxides do	93	148	Belgium-Luxembourg 98; France 42.
Metal and alloys:			
Scrap do	175	186	Netherlands 97; Switzerland 36.
Unwrought do	12,162	12,383	Netherlands 3,615; Indonesia 2,969; Malaysia 2,578.
Semimanufactures do	81	112	Netherlands 43; Belgium-Luxembourg 40.
Titanium:			
Ore and concentrate	374,394	457,411	Norway 223,325; Canada 171,234.
Oxides	2,477	3,077	Italy 1,231; France 525.
Metal, including alloys, all forms	1,193	1,323	U.S.S.R. 555; United States 446; Japan 183.
Tungsten:			
Ore and concentrate	4,482	5,574	Bolivia 1,186; mainland China, 981.
Metal, all forms	625	684	United States 195; France 130.
Uranium and thorium:			
Ores	45	279	United States 278.
Metal kilograms	NA	6,000	All from Great Britian.
Zinc and alloys:			
Ores	149,952	236,023	Canada 132,077; Sweden 44,777.
Metal, including alloys:			
Scrap	652	816	Sweden 227; Netherlands 216; Denmark 139.
Zinc dust	4,684	8,377	Belgium-Luxembourg 7,282; Yugoslavia 315.
Unwrought	141,881	187,018	Begium-Luxembourg 89,759; Congo (Kinshasa) 19,550; Netherlands 15,889.
Semimanufactures	17,697	15,817	Yugoslavia 10,214; Belgium-Luxembourg 3,216; France 1,838.
Zirconium metal, all forms kilograms	49,900	57,500	United States 26,600; France 21,700.
Other:			
Nonferrous ores and concentrates, n.e.s.	975	1,465	Bolivia 1,237.
Metalliferous waste	129,725	166,812	U.S.S.R. 24,229; Spain 22,442; United States 19,043; Norway 14,166.
Arsenic and tellurium	52	64	Sweden 37; U.S.S.R. 17.
Columbium kilograms	1,000	929	Switzerland 615; United States 133.
Phosphorus and selenium	NA	15,134	NA.
Pyrophoric alloys	27	45	Austria 36.
NONMETALS			
Abrasives:			
Natural:			
Industrial diamond thousand carats	520	675	Belgium-Luxembourg 225; Republic of South Africa 195.
Dust and powder of gem stones do	1,433	1,994	Netherlands 523; Belgium-Luxembourg 488; United Kingdom 311.
Diatomite and other siliceous earths	69,108	63,417	Denmark 43,881; France 11,571.
Manufactured (grinding stone)	2,550	2,987	Austria 820; France 710; Sweden 422.
Artificial:			
Corundum	4,607	5,942	Austria 3,080; Netherlands 845; France 610.
Silicon carbide	8,101	11,377	Norway 7,238; Italy 1,382; France 1,365.
Asbestos:			
Crude or partially worked	125,798	188,111	Canada 86,245; U.S.S.R. 43,935; Republic of South Africa 27,762.
Asbestos manufactures	5,893	9,289	United Kingdom 3,192; France 1,574; Denmark 1,571; Netherlands 1,382.
Asbestos cement products	89,973	107,015	Belgium-Luxembourg 32,539; Sweden 15,766; France 5,371; Netherlands 3,095.

See footnote at end of table.

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Table 4.—Federal Republic of Germany: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS—Continued			
Barite and witherite	89,280	44,094	Turkey 10,602; mainland China 7,960.
Boron salts, natural	92,586	102,649	United States 87,830; Turkey 11,370.
Boric oxide and acid	9,079	13,476	France 6,158; United States 6,073.
Cement, hydraulic—thousand tons	396	440	France 176; Switzerland 82; Belgium-Luxembourg 71; Poland 44.
Chalk—do	110	114	France 93; Denmark 14.
Clays, crude:			
China clay (kaolin)—do	398	506	United Kingdom 314; United States 74; France 58.
Fire clay—do	157	214	Czechoslovakia 82; Republic of South Africa 61; France 31.
Andalusite—do	194	224	Netherlands 62; France 86; Belgium-Luxembourg 30; United Kingdom 17.
Cryolite and chiolite	1,605	1,548	Denmark 1,538.
Diamond, except powder, dust and other:			
Crude or rough cut-thousand carats	400	315	NA.
Worked—do	150	205	Belgium-Luxembourg 95; Israel 55; Netherlands 30.
Other precious or semiprecious:			
Crude or rough cut	539,737	456,502	Brazil 435,940; Madagascar 16,204.
Worked—kilograms	2,189	2,250	India 723; mainland China 517; Japan 208.
Feldspar	48,745	57,647	Norway 26,622; Italy 14,183.
Fertilizer materials:			
Crude natural:			
Phosphatic—thousand tons	2,761	2,588	United States 1,252 U.S.S.R. 822; Morocco 220.
Nitrogenous	3,764	2,218	All from Chile.
Organic (including guano)	17,166	18,681	Netherlands 11,940; Peru 3,417; France 2,893.
Manufactured:			
Nitrogenous	388,234	249,805	NA.
Phosphatic:			
Basic slag	535,863	516,413	Belgium-Luxembourg 465,441; United Kingdom 35,975.
Other	28,639	28,525	United States 19,525; Netherlands 3,014.
Potassic	91,544	83,008	Canada 54,685; France 20,766.
Other	23,153	147,056	Belgium-Luxembourg 120,565; France 22,933.
Ammonia, anhydrous	27,105	30,121	Netherlands 17,800.
Fluorspar	118,442	153,486	France 80,945; Spain 31,963.
Graphite, natural	16,974	20,937	Austria 6,395; mainland China 3,649; Norway 2,606.
Gypsum	121,295	124,002	Austria 87,151; France 35,654.
Lime, hydraulic or slaked	130,945	146,708	France 141,516.
Magnesite:			
Crude	1,508	1,460	Greece 525; Netherlands 479; Austria 55.
Caustic calcined, sintered or fired	302,259	399,765	Austria 171,636; Czechoslovakia 120,587.
Refractories	24,616	36,258	Austria 35,298.
Mica:			
Crude, including splittings and waste	7,928	8,101	Republic of South Africa 1,886; United Kingdom 1,421; India 1,302.
Worked, including agglomerated splittings	15	290	France 157; Belgium-Luxembourg 45.
Pigments:			
Earth colors, natural	2,598	3,454	Austria 1,820; Sierra Leone 893; Republic of South Africa 362.
Iron oxides and hydroxides	10,984	1,408	France 678; United States 295; Spain 229.
Pyrite (gross weight)—thousand tons	1,437	1,892	Spain 660; Norway 420; Cyprus 308; U.S.S.R. 217.
Salt	125,582	146,126	Netherlands 129,373; France 15,671.
Stone, sand and gravel:			
Dimension stone:			
Crude:			
Marble—thousand tons	143	174	Italy 74; Portugal 17.
Slate—do	7	7	Norway 3; France 2.
Granite—do	614	507	Sweden 220; Austria 103.
Worked:			
Building and momumental—do	175	198	Italy 172.
Paving blocks and flagstones—do	95	143	Portugal 93; Poland 18; Austria 18.
Slate—do	13	10	Italy 7.
Dolomite—do	241	305	Belgium-Luxembourg 222; Austria 48.
Gravel and crushed rock—do	9,271	10,173	France 6,109; Denmark 1,869.
Limestone (except dimension) do	1,415	1,287	Austria 959; Sweden 190.
Quartz and quartzite	49,821	59,330	Belgium-Luxembourg 26,712; Sweden 11,751.
Sand, excluding metal bearing—thousand tons	1,874	2,115	France 1,412; Belgium-Luxembourg 300; Netherlands 253.

See footnote at end of table.

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Table 4.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS—Continued			
Sulfur:			
Elemental.....thousand tons..	324	251	France 80; Poland 13.
Elemental, collodial.....	134	196	Italy 166.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural.....	18,779	19,943	Trinidad 12,829; United States 6,965.
Carbon black.....	33,791	37,057	Netherlands 12,293; United States 10,170; France 6,764.
Coal, lignite and peat:			
Anthracite and bituminous thousand tons..	6,577	5,588	United States 3,409; United Kingdom 775; Poland 499; France 376.
Bituminous briquets.....do....	275	311	Netherlands 297.
Lignite and lignite briquets..do....	1,146	1,179	Czechoslovakia 1,167.
Peat and peat briquets.....do....	18	27	Netherlands 16; Denmark 2.
Coke, except petroleum coke.....do....	566	353	Netherlands 173; Belgium-Luxembourg 52; United Kingdom 35.
Gas, natural.....	721,868	2,313,058	Netherlands 2,258,488; France 21,817.
Petroleum:			
Crude, including shale oil thousand tons..	71,999	84,071	Libya 36,616; Saudi Arabia 13,438.
Refinery products:			
Gasoline.....do....	3,262	3,597	Netherlands 1,140; France 575; Italy 560; Belgium-Luxembourg 337.
Kerosine.....do....	415	425	Netherlands 114; Belgium-Luxembourg 108; United Kingdom 78.
Distillate fuel oil.....do....	11,362	12,569	Italy 4,047; U.S.S.R. 1,145; France 1,091; United Kingdom 733.
Residual fuel oil.....do....	2,462	2,807	Netherlands 870; France 839; Bunkers 354.
Lubricants.....do....	158	174	United Kingdom 36; Netherlands 34; United States 32; Curacao 32; Italy 23.
Mineral jelly, wax.....do....	58	54	United States 29; Netherlands 9; Indonesia 6; France 4.
Nonlubricating oils.....do....	686	170	France 61; Netherlands 46; Venezuela 22.
Pitch and pitch coke....do....	31	37	Czechoslovakia 29; Poland 5.
Petroleum coke.....do....	333	324	United States 317.
Petroleum and shale oil residues do....	320	276	France 169; Netherlands 80.
Bitumen and asphalt mixtures do....	16	14	Netherlands 7; United Kingdom 3.
Tar, mineral and other crude chemicals from coal, petroleum and natural gas..	270,320	325,328	Netherlands 96,724; Czechoslovakia 38,156; Belgium-Luxembourg 27,045; United Kingdom 6,820.

NA Not available.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—*Production, Consumption, and Trade.*—Production of primary aluminum, semimanufactures, and castings increased by 2, 19, and 22 percent, respectively. The productive capacity for semimanufactures was fully utilized. Of the output of 563,000 tons of semimanufactures, 45,000 tons was conductors.

While aluminum consumption (including exports) in West Germany during the 1958–68 decade increased by an average of 10 percent per year, the annual rate of increase in 1967 and 1968 were 23 and 27 percent, respectively. Domestic consumption is expected to increase to 1.1 million tons in 1975.

Aluminum consumption in 1969 was 640,000 tons of primary and 240,000 tons of secondary aluminum. The total was approximately 20 percent more than in 1968. Imports of aluminum ingots increased by about 44 percent, to 422,000 tons (311,000 tons unalloyed and 111,000 tons alloyed) and of semimanufactures by 32 percent, to 91,000 tons. One-third of the aluminum ingots and 85 percent of the semimanufactures originated from other countries of the European Economic Communities (EEC). In addition, Germany imported 81,000 tons of aluminum scrap. German aluminum exports comprised 36,000 tons of ingots, 103,000 tons of semimanufactures, and 7,000 tons of scrap.

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Principal domestic aluminum consumers and their shares of consumption (excluding those for export) in 1968 were as follows, in percent: Transportation 25.2; electrotechnology 15.6; building industry 14.0; machinery 9.9; packaging 9.3; iron and steel industry 5.1; metal wares 5.1; chemical and food industry and agriculture 2.7; household industries 2.7; aluminum powder users 1.1; and miscellaneous 9.2.[3]

Shipments of aluminum semimanufactures totaled about 560,000 tons.

At the beginning of the year the EEC allowed West Germany a low-duty (5-percent) import quota of 66,000 tons for aluminum, which was subsequently increased twice to a total of 84,296 tons. This quota was exhausted by mid-year.

The price of aluminum ingots was increased on March 1 to 58.5 U.S. cents per kilogram, and at the same time a revocable discount of 2½ cents per kilogram was granted on this price to compensate for the 4-percent reduction in price which German aluminum importers received under the foreign trade compensation law. With the revaluation of the West German Mark (DM) at the end of October, aluminum ingot price was lowered to DM 2.25 per kilogram or about 25 cents per pound at the new rate of exchange.

Industry Developments. Kaiser Aluminum & Chemical Corp. and Preussag A.G. agreed to expand their cooperation in the European aluminum markets to include all forms of primary and fabricated aluminum.[4] For this purpose a new organization, Kaiser Preussag Aluminium G.m.b.H. was formed, owned equally by Kaiser and Preussag. The company will build fabricating facilities which, together with the plant under construction at Voerde for the production of primary aluminum, will represent assets of $150 million.

Leichmetallgesellschaft m.b.H., a joint subsidiary of the three companies, Aluminium-Huette Rheinfelden G.m.b.H., Aluminium Walzwerke Singen, and Metallgesellschaft A.G., will expand their plant under construction at Essen from 84,000 to 126,000 tons annual capacity.

Gebrueder Giulini G.m.b.H. completed the construction of an aluminum smelter in Ludwigshafen in September and started production shortly thereafter. The plant has an annual capacity of 22,000 tons of aluminum but company plans call for doubling the capacity by the end of 1972. The expansion includes provision for delivery of molten aluminum to customers.

Copper.—Copper consumption increased by about 20 percent, the latter to 675,400 tons. Trade in copper in 1969 was as follows, in tons: [5]

	Imports	Exports
Ore	205,802	------
Matte	674	------
Scrap:		
Copper	61,287	7,792
Copper alloy	61,897	23,148
Metal:		
Blister for refining	144,802	1,201
Refined, not alloyed	355,943	95,471
Refined, alloyed	61,648	8,723
Semimanufactures (bars, rods, wires, sheets, foils, pipes, and accessories):		
Unalloyed	43,226	87,219
Alloyed	32,429	56,762
Flakes and powder:		
Unalloyed	149	1,843
Alloyed	60	2,468

Compared with 1968 imports, imports of all classes of copper, other than ore, matte, and blister, increased. Exports were not significantly different from 1968 except those for refined copper, which were about 44,000 tons less than in the previous year.

Prices of copper wire bar during the year were as follows, in U.S. dollars per ton: [6] January—1,170 to 1,950; June—1,392 to 1,550; December—1,735.

Iron Ore.—The decline in iron ore production continued and in terms of iron content, domestic ore accounted for 7 per-

[3] Ernest, Lenore. Aluminium (Duesseldorf), No. 45, December 1969, pp. 781–786.

[4] Metal Bulletin (London). No. 5461, Dec. 31, 1969, p. 19.

[5] In addition, 1549 tons of "pre-alloys" were imported and 573 tons were exported.

[6] For January and June figures, the DM was converted at the rate of 4DM=US$1.00; for December, the conversion rate of DM3.66=US$1.00 was used.

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cent of total iron ore and about 6 percent of all iron bearing materials consumed in the production of pig iron.

Iron ore imports which totaled 43,813,000 tons (including 392,000 tons of manganiferous iron ore) were substantially larger than in the previous year. Principal suppliers and imports from these sources were as follows, in thousand metric tons: Sweden 13,567; Liberia 6,666; Brazil 6,832; France 5,302; Angola 2,182; Canada 2,056; Venezuela 1,734; and Mauritania 1,231. In addition, West Germany imported 1,635,100 tons of cupriferous and noncupriferous pyrite cinders, mainly from Spain, Italy, and Belgium-Luxembourg.

Iron and Steel.—In spite of a record crude steel output of 45 million tons, the West German industry could not meet steel demand within the customary delivery dates. It is estimated that about 25 percent of the steel market was satisfied by foreign steel compared with 30 percent in 1968. The decline resulted from worldwide competition for steel. The 10-percent rise in crude steel output was higher than the increase in employment (less than 2 percent), indicating greater productivity. Capacity utilization reached 93 percent in the second half of the year. Investment in the industry totaled $850 million.

Raw Material Consumption.—Of the 49 million tons of iron ore used in pig iron production, almost 35 million tons was sintered prior to smelting in a blast furnace. The iron and steel industry (blast furnaces, steel plants, rolling mills, forge and hammer mills) consumed 23 million tons of solid fuels (equivalent to 29 million tons of coal), of which coke and coke breeze accounted for 21.8 million tons. In addition, the industry used 3.58 million tons of liquid fuels, and 20,224 million cubic meters of coke and blast furnace gas.[7]

Production and Shipments.—West Germany's share of world steel output increased slightly to 7.9 percent (7.7 in 1968), and the country ranked fourth among world producers. Of the crude steel produced in 1969, about 5 million tons was special steels. The production of all classes of rolled steel, except hot-rolled wide strip, increased. There was a further decline in the number of Bessemer and open-hearth furnaces and an increase in the number of oxygen converters in operation.

Steel shipments in 1969 were as follows, in million tons:

	1968	1969
Semifinished	r 12.0	13.5
Rolled steel	r 25.5	29.2
Total	r 37.5	42.7

r Revised.

The semifinished steel consisted of 7.5 million tons of marketed intermediate products and 6 million tons of hot-rolled wide strip. Of rolled-steel shipments, flat products totaled 13.8 million tons (excluding 884,000 tons of galvanized and 736,000 tons of tinplate); bars 5.4 million tons, and wire rods 3 million tons.

[7] Converted to 4,300 kilocalories per normal cubic meter.

Table 5.—Federal Republic of Germany: Scrap supply and consumption

(Thousand metric tons)

	1967	1968	1969
Source:			
Iron and steel plants	9,075	10,134	10,640
Foundries	2,135	2,479	2,738
Purchases:			
Domestic	6,254	6,945	8,265
Imported	1,078	1,566	1,141
Other, including variation in stock estimates	2,654	r 2,684	2,305
Total, new supply	21,196	23,807	25,089
Consumption:			
Iron and steel plants	15,290	17,043	18,379
Iron and steel foundries	4,054	4,620	5,088
Consigned for export	2,092	1,825	1,757
Stocks at yearend	1,750	2,071	1,936

r Revised.

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Table 6.—Federal Republic of Germany: Salient statistics of the iron and steel industry

(Thousand metric tons unless otherwise specified)

	1967	1968	1969
PIG IRON			
Producing plants—number	30	25	25
Blast furnaces available—do	139	128	110
Blast furnaces in operation at yearend—do	91	88	91
Maximum production capacity	35,900	37,040	36,800
Production:			
Thomas	13,485	14,248	15,344
Open hearth	11,987	13,929	15,857
Foundry	249	r 279	305
Spiegeleisen and blast furnace ferromanganese	254	328	238
Other	1,391	1,522	2,020
Total	27,366	30,305	33,764
Blast furnace charge:			
Iron ore:			
Domestic	1,422	1,435	1,525
Iron content	528	517	509
Imported	12,262	14,724	18,548
Iron content	6,963	8,791	11,255
Sinter and briquets	30,602	32,354	34,147
Iron content	16,930	17,859	18,854
Manganese ore	580	707	542
Iron content	80	83	72
Other iron-bearing materials:			
Slag, scale, cinder, dust	8,217	8,356	8,728
Scrap	541	499	518
Limestone	1,344	1,280	1,139
Phosphate rock	190	202	186
Coke:			
Total	16,516	17,546	19,038
Kilograms per ton of pig iron produced	599	r 577	563
STEEL			
Converters:			
Basic Bessemer:			
Total—number	54	43	34
In operation at end of year—do	44	36	29
Oxygen:			
Total—do	26	31	34
In operation at end of year—do	21	26	25
Furnaces:			
Open hearth:			
Total—do	150	134	121
In operation at end of year—do	96	95	92
Electric:			
Total—do	189	185	183
In operation at end of year—do	166	172	165
Maximum production capacity (all furnaces)	48,400	48,570	49,440
Production of crude steel:			
Basic Bessemer	8,467	7,664	6,807
Oxygen	11,562	15,258	20,888
Open hearth	13,599	14,544	13,515
Electric	8,108	8,684	4,146
Other	8	10	10
Total	36,744	41,159	45,316
Ingots	36,218	40,526	44,599
Liquid steel for castings	526	633	717
Furnace feed for ingot steel:			
Pig iron:			
Total	24,717	27,722	30,860
Kilograms per ton crude steel	(682)	(684)	(692)
Scrap:			
Total	14,739	16,536	17,855
Kilograms per ton crude steel	(407)	(408)	(400)
Preblown Thomas and other presmelted steels	62	17	51
Ferroalloys and alloying metals	284	354	409
Other iron bearing materials	847	972	1,113
Iron and manganese ores	846	1,010	990
Total iron-bearing materials	41,495	46,612	51,279
Limestone	2,761	3,118	3,379
CASTINGS			
Iron and steel foundries in operation—number	909	881	NA
Production of iron and steel castings	3,579	4,156	4,659

See footnotes at end of table.

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Table 6.—Federal Republic of Germany: Salient statistics of the iron and steel industry—Continued

(Thousand metric tons unless otherwise specified)

	1967	1968	1969
CASTINGS—Continued			
Consumption of raw materials:			
Pig iron	1,455	1,790	2,101
Scrap	4,054	4,620	5,088
Ferroalloys and other metals	68	77	83
Total	5,577	[1] 6,485	7,272
EMPLOYMENT			
In coking plants of smelters—persons	2,237	1,892	2,196
Blast furnace, steel mills, hammer and forge shops—do	361,512	364,870	371,622
Foundries—do	144,821	149,167	NA

r Revised. NA Not available.
[1] Data may not add to total shown because of independent rounding.

Table 7.—Federal Republic of Germany: Raw materials consumed in the production of pig iron

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969
Iron ore:			
Domestic	6,365	6,310	5,980
Imported	33,634	37,721	43,325
Total	39,999	44,031	49,305
Manganese ore	659	851	665
Pyrite cinder	4,240	3,907	3,879
Slags and plant scales	5,221	5,589	6,322
Blast furnace dust	1,465	1,492	1,687
Scrap	542	500	518
Total metallic raw materials:			
Gross weight	[1] 52,125	[1] 56,369	62,376
Iron content:			
Iron ore:			
Domestic	2,027	2,011	1,916
Imported	18,805	21,517	24,853
Manganese ore	86	94	77
Pyrite cinder	2,070	1,919	1,894
Slags and plant scales	2,333	2,240	2,730
Blast furnace dust	542	542	629
Scrap	457	414	412
Total iron content	26,320	28,737	32,511
Limestone	2,982	3,108	3,425
Per ton of product	109	103	101
Phosphate	192	204	186
Total gross weight of metallic raw materials, limestone, and phosphate	55,300	59,681	65,987
Coke	16,516	17,546	19,038

[1] Data may not add to total shown because of independent rounding.

Table 8.—Federal Republic of Germany: Production and consumption of sinter

(Thousand metric tons unless otherwise specified)

	1967	1968	1969
Production:			
Gross weight	30,669	32,280	34,159
Iron content	16,998	17,839	18,882
Consumption of raw materials:			
Iron ore	26,394	28,016	29,353
Cinder	4,184	3,860	3,840
Slags and scale	2,060	2,285	2,635
Blast furnace dust	1,465	1,487	1,686
Limestone	1,638	1,828	4,286
Iron content of materials consumed:			
Iron ore	13,347	14,231	15,010
Cinder	2,058	1,909	1,885
Slag and scale	1,086	1,202	1,425
Blast furnace dust	542	540	628
Total	17,033	17,882	18,948

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Table 9.—Federal Republic of Germany: Production of finished steel
(Thousand metric tons)

	1967	1968	1969
Wire rods	2,844	3,122	3,394
Bars and rods	5,039	5,563	6,306
Angles, shapes, sections (excluding rails)	2,057	2,155	2,423
Universal plates	370	465	565
Other heavy plates and sheets (more than 4.75 millimeters thick)	3,445	4,025	4,671
Medium plates and sheets (3 to 4.75 millimeters)	459	521	643
Thin plates and sheets (less than 3 millimeters)	4,670	6,199	6,937
Hot rolled strip including skelp	2,253	2,642	3,075
Hot rolled wide strip	1,652	2,018	1,998
Rails and railway track material	514	374	445
Seamless steel tubes	1,619	1,618	1,794
Total finished steel	24,922	28,697	[1]32,247
Selected semimanufactures:			
Tin plate	[r]606	[r]626	720
Galvanized and ternplate	[r]665	[r]893	1,000
Steel pipe welded	1,022	1,222	1,556
Extrusions and forgings	499	600	677
Steel castings	272	325	378

[r] Revised.
[1] Data may not add to totals shown because of independent rounding.

Trade.—Trade in iron and steel by principal categories in 1969 was as follow, in thousand tons:

	Imports	Exports
Scrap	1,208	1,831
Pig iron and blast furnace ferroalloys	299	1,030
Steel:		
Semifinished	882	969
Rolled steel	7,471	9,106
Pipes and fittings	237	1,622
Forgings, wheels, and axles	20	102
Total steel	8,610	11,799

The export surplus in steel categories listed in the preceding tabulation continued to decline in 1969 and amounted to about 3.2 million tons compared with 4.8 million tons in 1968 and 6.7 million tons in 1967.

Industry Developments.—West Germany's two biggest steel pipe producers, Mannesmann A.G. and August-Thyssen Huette A.G. (ATH), agreed to merge their pipe production in one new company, Mannesmannroehren-Werke A.G. Two-thirds of the stock of the new company will be owned by Mannesmann. Under the agreement, ATH takes over most of the rolling facilities of Mannesmann which will cease producing rolled steel. The two companies account for two-thirds of West Germany's pipe production; their share of the West German market is estimated to be 50 percent. In view of the dominant position of the new company, the Ministry of Economics was envisaging some form of supervision to insure that interests of other producers as well as consumers are protected. In merger activities, there were also negotiations for a merger between Salzgitter A.G. and Ilseder Huette.

Ground was broken in Hamburg for a 450,000-ton-per-year steel plant which will smelt prereduced pellets in electric furnaces. The rolling mill will produce wire rod, bars, and other products. Total investment is estimated at $38 million. The company named Hamburger Stahlwerke is owned jointly by a U.S. firm Midland-Ross Corporation of Cleveland, Ohio, and Korf Industrie und Handel G.m.b.K.G. and will use the prereduction method developed by the Midrex Division of Midland-Ross.

The Kloeckner-Werke A.G. has an extensive investment program designed to expand the steel capacity of its plant at Bremen. Here the wide hot-strip mill will be replaced by a new unit which will have an initial annual capacity of 3 million tons. The LD plant will also be expanded.

Hoesch, A.G., the second largest steel combine in West Germany also has big investment plans involving a new plant on the sea coast. In cooperation with Koninklijke Nederlandsche Hoogovens en Staalfabricken N.V. (Hoogovens) of the Netherlands, Hoesch was planning to build a steel plant in Rotterdam at a cost of about $400 million. The plant will have an initial annual capacity of 2.4 million tons, which will eventually be increased to 8 million tons.

Wage increases of 11 percent were granted following strikes in the industry. As a result, the industry announced price increases of 8 percent to go into effect at the beginning of 1970 to cover an additional $275 million in labor costs.

The Federal Economics Ministry has

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expressed the opinion that the greatly improved steel market situation obviates the need for extension of the authorization of the four steel sales organizations beyond its expiration date of June 30, 1971.

Lead-Zinc.[8]—The main features of the lead-zinc industry were decline of mine output of lead; almost no changes in mine output of zinc compared with the previous year; almost a doubling of zinc metal output; and small increases in production of primary and secondary lead. With the closure of the Maubach mine, five lead-zinc mines were in operation with 3,382 persons employed at the end of 1968.

The substantial rise in output of zinc resulted from the full operation of the Datteln zinc plant during the year. Of the ore smelted in West German lead furnaces, 31 percent was of West German origin; 59 percent of the lead output was obtained from material other than ore. For zinc, 51 percent of the ore smelted was of West German origin and 78 percent of the zinc output came from ore. In 1969 nearly 100,000 tons of crude lead, essentially from Imperial Smelting Furnaces, was refined in West Germany, of which 40,000 tons was smelted in Germany.

Refined lead and slab zinc consumption during the year were estimated at 305,000 and 390,000 tons respectively. Principal consumers of lead (refined and other) and of zinc (slab zinc and other) in 1968 and 1969 were as follows, in thousand metric tons: [9]

[8] Fachvereinigung Metallerzbergbau e.V. Jahresbericht und Statistik (Yearly report and statistics, Trade Association, Metals Mining Ind. Org.). 1969, pp. 1–26.

[9] World Metal Statistics (London). V. 23, No. 4, June 16, 1970, pp. 44 nd 46.

	1968	1969
Lead:		
Cable sheath	84.6	85.4
Storage batteries	95.6	108.2
Pigments and chemicals	58.6	64.4
Semimanufactures	55.1	58.4
Castings	6.1	7.0
Type metal, anti-friction metal, and lead-tin alloys	4.0	4.9
Protection of surfaces, powders, etc	5.0	4.9
Collapsible tubes and capsules	8.1	27.2
Miscellaneous	10.1	
Total	322.2	360.4
Zinc:		
Galvanizing	128.9	139.4
Die-casting alloys	69.8	80.3
Brass and rolled zinc	202.1	208.5
Oxides	28.1	24.5
Miscellaneous	.8	.1
Total	429.7	452.8

Lead consumption for batteries and chemicals increased and is expected to continue to increase, a trend existing also in other principal consuming countries. For zinc, galvanizing and die-casting accounted for much of the increase; galvanizing alone accounted for a 30-percent increase in total consumption compared with about 25-percent increase in 1964.

Prices of lead and zinc during the year were as follows, in U.S. dollars per ton:

	January	June	December [1]
Lead	250	292	352
Zinc	272	287	317

[1] The increased price is partly accounted for by using the revalued rate of exchange of DM3.66 = US $1.00 for December.

Trade in lead and zinc was as follows, in thousand tons:

Commodity	Imports	Exports
Lead:		
Ore and concentrate	232.0	8.0
Scrap	21.0	8.0
Metal:		
Crude lead for refining	55.4	.7
Refined lead	44.5	31.6
Lead-antimony alloys	9.6	4.6
Other lead alloys	2.7	2.5
Total	112.2	39.4
Zinc:		
Ore and concentrate	351.0	60.0
Scrap	1.0	6.0
Metal:		
Crude	61.8	20.5
Refined	113.8	8.4
Remelted	1.0	2.9
Alloys	6.4	3.7
Total	182.5	35.5

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In 1970 Preussag A.G. will start building an electrolytic zinc plant at Nordenham with a 90,000-ton-per year capacity. The plant will be operated by Preussag Weser-Zink G.m.b.H., 75 percent owned by Preussag and 25 percent by Peñarroya.

The annual smelting capacity for these two metals is to be increased to 350,000 tons each by 1972. At this time it is estimated that the industry will need to import 140,000 to 160,000 tons of zinc in ore and 120,000 to 140,000 tons of lead to supplement the domestic production which is expected to increase to 120,000 tons of zinc and 45,000 tons of lead in ores.

Magnesium.—There were press reports [10] of plans for a second magnesium plant in addition to the plant to be built jointly by Salzdetfurth A.G. and Norsk Hydro-Elektrisk Kvaelstofaktieselskab (Norsk Hydro), based on potash salts. The Salzdetfurth plant will have a maximum annual capacity of 30,000 tons and should come into operation in 1971.

In 1969 West Germany imported 41,113 and 7,864 tons of alloyed and nonalloyed magnesium alloys, respectively. Norway and the United States were the largest suppliers, in the order given. The Volkswagen plant is the principal consumer of magnesium alloys, each car containing 20 kilograms of magnesium castings.

Nickel.—In spite of a world shortage of nickel and high prices, West Germany consumption is estimated to have increased from 35,000 tons in 1968 to about 37,000 tons in 1969. Increase in the production of alloy steels (from 3,063,000 and 3,931,000 tons) and of stainless steel (from 416,000 to 485,000 tons) may have been the principal factors in the higher nickel consumption. Germany's trade in nickel metal was as follows, in tons:

	Imports	Exports
Scrap nickel	15,237	1,985
Nickel metal	25,212	519
Nickel alloys	3,203	237

Tin.—Statistical data for tin, in tons, were as follows.

Production (primary and secondary)	[1] 2,415
Imports:	
Ore	[2] 7,778
Scrap	82
Metal	14,863
Alloys	695
Exports:	
Ore	1
Scrap	82
Metal	1,101
Alloys	413
Consumption (primary and secondary)	14,930

[1] Of which 951 tons was secondary.
[2] Metal content 907 tons.

Important sources for unalloyed tin were the Netherlands 3,942 tons; Indonesia 3,866 tons; Malaysia 2,653 tons; and the United Kingdom 1,262 tons. This latter country was the principal source for tin alloys (474 tons).

Based on data for the first three quarters of 1969, tinplate accounted for 31.4 percent of tin consumption in West Germany, followed by solders 11.9 percent; tinning 8.4 percent; antifriction metals 2.1 percent; brass and bronze 19 percent; and miscellaneous for the remainder.

Uranium.—In November, West Germany, the Netherlands, and United Kingdom reached an agreement to develop the gas centrifuge technique for the enrichment of uranium. The isotope separation plants at Almelo (Netherlands) and Capehurst (United Kingdom) will be built by a tripartite Prime Contractor Organization with headquarters at Bernsberg, West Germany. Germany is represented in the Prime Contractor Organization by the Gesellschaft fuer nukleare Verfahrenstechnik m.b.H. (GnV) established in November. GnV will develop, plan, and build isotope separation facilities using centrifuges. West Germany's one-third share in the tripartite enrichment Organization with headquarters in London will be represented by Uranit G.m.b.H., established also in November with headquarters in Juelich.

West Germany's imports of uranium are comprised of 10 tons from the Republic of South Africa with more than 5 percent uranium content and 5,145 tons from France with 5 percent or less uranium content. West Germany also imported 39.5 tons of enriched uranium; 17.6 tons from France; 14.7 tons from the United States; and 7.2 tons from the United Kingdom.

[10] Metal Bulletin (London). No. 5461 Oct. 24, 1969, p. 20.

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NONMETALS

Cement.—Salient statistics of the cement industry in 1969 in thousand tons, except as otherwise quoted, were as follows:

Annual production capacity	39,000
Production	35,079
Share of world production (percent)	6.4
Imports:	
Clinker	68
Portland	188
Iron Portland and blast furnace slag	241
Other	35
Exports:	
Clinker	79
Portland	1,058
Iron Portland and blast furnace slag	416
Other	96
Apparent consumption	33,700
Per capita consumption (kilograms)	550
Employment (number)	18,000

The 1-million-ton increase in capacity compared with 1968 capacity was brought about by additions to existing plants.

Fertilizers.—Production of the three types of fertilizers increased. The rising trend in nitrogenous fertilizers continued with almost all the increase in compound fertilizers. Of the marketable potassic fertilizers, all but 37,000 tons of crude salt was chemically treated and had a K_2O content of more than 20 percent. Although the decline in the production of phosphatic fertilizers in 1968 was reversed, the 1967 level (973,638 tons P_2O_5) was not achieved. The trend in phosphatic fertilizer output is influenced by the declining production of basic slag.

Shipments to the domestic market during 1967–68 and 1968–69 (July 1 to June 30) in thousand tons, were as follows:

	1967–68	1968–69
Potassic (K_2O)	1,119	1,046
Straight	521	453
Compound	598	593
Nitrogenous (N)	950	933
Straight	671	640
Compound	279	293
Phosphatic	806	802
Straight	388	367
Compound	418	435

While total shipments of the three classes of fertilizers declined, shipments of nitrogenous and phosphatic compound fertilizers increased.

West Germany exported $162 million of fertilizer materials: Nitrogenous $51 million; potassic $56 million; phosphatic $4 million; and mixed $51 million. Imports totaled $84 million of which phosphate rock, including ground, accounted for $43 million, other natural fertilizers $1 million and processed fertilizer the remainder as follows, in million dollars: nitrogenous 14, phosphatic (principally Thomas slag) 8; potassic 3; and mixed 16. In terms of tonnage West Germany's fertilizer trade was as follows, in thousand tons:

Type	Imports	Exports
Nitrogenous:		
Crude	19	------
Processed	292	1,553
Phosphatic:		
Phosphate rock	2,726	2
Thomas slag	424	230
Superphosphate	28	15
Other	2	4
Potassic:		
Crude	------	48
Potassium chloride	86	1,429
Potassium sulfate and other	2	352
Mixed	243	893
Packaged	1	1

The trade surplus of $95 million in 1968 was reduced to $78 million in 1969 because of larger imports, with exports about the same in value as in 1968. The share of potassium sulfate in potash exports increased.

The potash selling organization Verkaufgemeinschaft Deutscher Kaliwerke (VDK), representing the four German producers will continue to function until December 31, 1972.[11]

Sulfur.—Based on data for the first three quarters, Germany produced about 392,000 tons of contained sulfur, of which 264,000 tons was recovered from pyrite, 91,000 tons from oil and natural gas, 22,000 tons from coal, and 15,000 tons from other sources. Consumption of sulfur, elemental and sulfur in pyrite, may have totaled 1.5 million tons, the deficit being made up by imports.

While imports of pyrite (unroasted) declined from 1,891,569 tons in 1968 to 1,803,213 tons in 1969, elemental sulfur imports (excluding chemically pure) increased from 251,351 tons in 1968 to 320,781 in 1969. Sources for both commodities were essentially the same as in the previous year, but imports from Poland increased from 12,619 to 30,383 tons and 19,063 tons were imported from the U.S.S.R. West Germany's pyrite exports were insignificant but 31,423 tons of sulfur was exported.

[11] Industrial Minerals (London). No. 24, September 1969, p. 48.

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In 1970, Mobil Oil A.G. plans to begin recovering sulfur from oil refinery feedstocks at Worth in a unit with a rated capacity of 10,000 tons of sulfur per year.

MINERAL FUELS

Energy consumption in 1969 totaled 320 million tons of standard coal equivalent (SCE), of which 65 million tons SCE was petroleum products used for transportation motive power and nonenergy uses. Total consumption was 25.9 million tons (8.8 percent) more than in 1968; 3.6 million tons of the increase was in motive power and nonenergy uses. The shares of the different energy sources and the corresponding 1968 figures were as follows:

Energy source	Percent of total primary energy consumption	
	1968	1969
Bituminous coal and anthracite	33.3	31.5
Lignite and "pech" coal	9.8	9.3
Petroleum	50.2	52.2
Natural gas	3.1	3.6
Hydroelectricity	2.6	2.1
Nuclear energy	.2	.5
Wood, peat, other	.8	.8
Total	100.0	100.0

Consumption increases for purposes other than motive power and nonenergy uses in 1969 were as follows, in million tons SCE: Fuel oil 13.2; natural gas 3.9; coal 3.5. Imports accounted for about 45 percent of domestic consumption of primary energy.

The West German Economic Research Institute, which in 1968 prepared short-term and long-term market outlooks for coal, and forecast primary energy consumption of 354 million tons SCE in 1973, revised this 1973 figure to 368.2 million tons SCE [12] distributed as follows, in million tons SCE: Petroleum 207.2; coal 87.8; lignite 32.3; natural gas 27.7; hydroelectricity 11.7; other 1.5. Taking into account net coal exports as coal or coke, the total coal market in 1973 was estimated at 108.7 million tons. Powerplants will continue to be the major coal consumer in the domestic market (44 percent).

Installed powerplants are expected to grow 7.5 percent per year from 50,000 megawatts installed capacity in 1970 to 100,000 megawatts in 1980, one-third of the 1980 capacity being nuclear. In 1969 construction started on a 300-megawatt high-temperature gas-cooled reactor to be expanded to 600 megawatts.

Three nuclear powerplants will be built in the near future in the State of Baden-Wuerttemberg; as follows:

Location	Starting date	Initial capacity (megawatts)
Eichau on the Rhine	1974	700
Kirschgartshausen, northwest of Mannheim	1976	700
North of Stuttgart	NA	600–700

NA Not available.

Coal.—*Production, Consumption and Trade.*—With coal production almost the same as in 1968, stocks were further reduced by 5,871,000 tons to 2,557,000 tons at yearend. Simultaneously imports (including briquets) increased from 5,898,900 tons in 1968 to 6,788,400 tons in 1969 and exports (including briquets) declined from the 1968 level of 20,407,800 to 17,704,700 tons. The principal factors in the strong domestic demand for coal were the continued high level of economic activity, increased steel production, and larger coal consumption by powerplants. This was also reflected in increased coke output both at the cokeries of the coal mines as well as the steel plants. There was, however, a slight increase in exports of coke, 9,578,800 tons compared with 9,266,000 tons in 1968.

Coal availability and shipments during the year were approximately as follows in thousand tons:

Production	111,630
Withdrawal from stocks	5,871
Imports	6,788
Total available	124,289
Exports	17,705
Net available	106,584
Shipments:	
To mine facilities:	
Coke ovens	44,541
Briquet plants	3,804
Powerplants	11,640
Mine and miners consumption	•3,180
Subtotal	63,175
Other users:	
Transportation	1,729
Powerplants	20,204
Gasworks	2,993
Iron and steel	1,370
Other industry	10,534
Household and small consumers	7,411
Subtotal	44,241
Total inland shipments	107,416
Discrepancy	826

• Estimate.

[12] Deutsches Institut fuer Wirtschaftsforschung, No. 49, Dec. 4, 1969, Berlin.

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Table 10.—Federal Republic of Germany: Coal and lignite industry

(Production, productivity, and employment)

	1967	1968	1969
BITUMINOUS AND ANTHRACITE			
Production:[1]			
Ruhr, million tons	90.4	91.0	91.2
Saar, do	12.4	11.3	11.1
Aachen, do	7.0	7.3	6.7
Lower Saxony, do	2.2	2.4	2.6
Total, do	112.0	112.0	111.6
Output per man-shift:			
Ruhr:			
Underground, kilograms	3,366	3,644	3,774
Total mining, do	2,623	2,872	2,986
Federal Republic average:			
Underground, do	3,264	3,526	3,665
Total mining, do	2,561	2,794	2,913
Employment:			
Ruhr:			
Underground, thousand persons	133.3	117.5	111.0
Mine surface, do	38.7	32.9	31.6
Cleaning, do	19.1	17.2	15.8
Total including other workers and salaried employees, thousand persons	243.5	216.1	206.0
Federal Republic total:			
Underground, do	169.9	150.6	140.6
Mine surface, do	47.6	40.6	38.6
Cleaning, do	22.4	20.6	19.1
Total including other workers and salaried employees, thousand persons	304.8	272.2	257.7
LIGNITE AND SUBBITUMINOUS			
Production:			
Rhineland, millions tons	83.0	87.9	92.7
Helmstedt, Hesse, and Bavaria, do	13.8	13.6	14.7
Total, do	96.8	101.5	107.4
Employment:			
Rhineland:			
Open pit, thousand persons	8.3	7.4	6.5
All other, do	11.7	10.9	10.5
Total, do	20.0	18.3	17.0
Helmstedt, Hesse, and Bavaria, do	9.1	7.9	7.4
Total, do	29.1	26.2	24.4
PITCH COAL			
Production, millions tons	.9	.8	.8
Employment, thousand persons	2.6	2.3	1.9

[1] Excludes small mines and leases.

Collieries produced 25,345 million kilowatt hours of electricity from coal or 11.5 percent of total electricity output in the country. Public utilities and coal mines produced 80,035 million kilowatt hours of electricity from coal or 39.4 percent of total output. This however, does not include that share of power produced by industry and the railroads using coal. If electricity produced from lignite is included, mines and public utilities alone produced 130,798 million kilowatt hours from these fuels or 64 percent of the total.

Trade in solid fuels in 1969 was as follows, in thousand tons:

	Imports	Exports
Coal	6,340	17,552
Coal briquets	448	153
Coke[1]	677	9,579
Lignite	1,143	15
Lignite briquets	28	971
Lignite coke	52	------
Pech coal	------	28
Peat including briquets	33	214

[1] Of which 967 tons for electrodes.

Of coal and coke exports 89.4 and 82 percent, respectively, were shipped to the EEC. Principal sources for coal imports were as follows, in thousand tons: United States 3,094; United Kingdom 1,388; Poland 563; France (including coal briquets) and Bel-

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gium-Luxembourg 458 and 447, respectively.

The trend in the reduction of the labor force and increase in productivity continued. There were 70 mines in operation in 1969 compared with 80 the previous year.

Relative shares of different coal ranks produced were as follows, in percent: Medium to high-volatile coal (Flammkohle and Fettkohle) 86.7; low-volatile and semianthracite (Esskohle and Magerkohle) 5.8; anthracite 7.5. Prices of Ruhr coal, medium and high-volatile, in June 1969 ranged between $17 and $19.75 per ton, depending on size and grade. Low-volatile coal prices for the same area ranged between $17.75 and $23.50 per ton.

Industry Developments.—On July 18, the unified coal company for the coal mines of the Ruhr, Ruhrkohle A.G., was formally established and 20 coal companies signed the Basic Agreement (Grundvertrag) and four signed a special contract with Ruhrkohle A.G. These companies operate 47 mines, 28 coke ovens, and six briquetting plants, and employ 175,000. In 1968 they produced about 77 million tons of coal, 22 million tons of coke, and 2 million tons of briquets. Special arrangements were being prepared for two more firms to join Ruhrkohle A.G. The above companies together would account for 93 to 94 percent of the Ruhr's coal output.

Ruhrkohle A.G. has a share capital of $129.25 million on which no dividends will be paid for 20 years. It takes over the parent companies' entire coal industry assets and liabilities against an obligation to pay them with 6 percent interest in 20 yearly installments of $46.25 million.[12] The Federal and State Governments underwrite guarantees totaling $825 million. The parent companies have undertaken to reinvest the money received from Ruhrkohle A.G. to create new industrial opportunities in the Ruhr.

Outside the Ruhr, Saarbergwerke A.G. remained the only major coal producer in the Saar and Preussag A.G., in Lower Saxony.

During the year all existing eight pension funds were consolidated under the name of "Bundesknappschaft," which is self-governing.

Following a number of wildcat strikes, a new wage agreement was signed on September 23 which covered the entire industry in the coal mining districts of the Ruhr, Saar, Aachen, and Lower Saxony. Retroactive to September 1, 1969, the miners were to receive an additional 87.5 cents per shift. On January 1, 1970, new wage scales were to become effective incorporating the 87.5-cent increase and bringing about further increases in some wage groups. At the same time a longevity bonus, increased annual leave, and provision of work clothes, and cleaning of work clothes will be granted. The cost of these increases to the industry has been estimated at $60 million to $225 million. As a result the Ruhr coal mines increased coal prices in October by 11 percent for household coal and briquets and 12 percent for coking coal. Household coke and metallurgical coke prices were also increased by 16 and 19 percents, respectively.

To alleviate coal shortage, the Government took measures for the approval of an ordinance increasing the 1970 coal import quota from 6 to 7.2 million tons.

The Federal Ministry of Economics announced the relaxation of regional restraints on the sale of imported bituminous coal. Hitherto, the sale of coal imported from non-Community countries had been restricted to the north German coastal area. The new regulation permits the use of coal imported from non-Community countries by all qualified consumers who can show that they are unable to satisfy their requirements by purchases from Community sources.

Lignite (Braunkohle).—The production increase in 1968, which arrested 3 years of continuous decline, continued in 1969 with a further substantial rise in output. Lignite accounted for 16.6 percent of primary energy production and 9.3 percent of energy consumption. The Rhineland area accounted for 86.3 percent of total output followed by Helmstedt with 5.1 percent. Increase in output of the Rhineland area accounted for 82 percent of the total production increase of 5,908,000 tons.

The output was used as follows, in thousand tons: [1]

Briquets	21,783
For electricity production and mines, consumption	7,473
Other	710
Shipment to public utilities	72,156
Other sales	5,302
Total	107,424

[1] Braunkohle, Waerme und Energie (Duesseldorf). V. 22, No. 4, April 1970, p. 135.

[12] Converted at the rate of 4DM=US$1.00.

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During the year 55 billion kilowatts of electricity was produced in plants using lignite as fuels.

West Germany exported 971,000 tons of lignite briquets, mainly to other EEC countries, Austria, and Switzerland and imported 1,758,000 tons of lignite briquets from East Germany and 28,000 tons from Czechoslovakia.

Natural Gas.—Compared with 1968, natural gas production increased in all producing areas except the area between Elbe and Weser and the Upper Rhine Valley. The largest percentage increase was at the Ems Estuary (83 percent), followed by Alpine Foreland (39 percent) and an area between Weser and Ems (33 percent). The Bierwang field was the main factor in increased output from the Alpine Foreland. West German natural gas production is expected to increase to 15 billion cubic meters in 1972.

Natural gas imports increased by about two-thirds, 2.55 billion cubic meters. West Germany's natural gas requirements have been estimated at 28,000 to 30,000 million cubic meters in 1975 and 38,000 to 42,000 million cubic meters in 1980, both figures equivalent to 8 to 10 percent of total energy consumption.[14]

Natural gas sales, converted to the base of 4,300 kilocalories per cubic meter, increased 16 percent to 21.6 billion cubic meters, equivalent to 13.2 million tons of standard coal equivalent.

The Soviet offer, made at the 1969 Hannover fair, to deliver natural gas to West Germany in return for shipment of steel pipe from Germany to the Soviet Union led to serious negotiations during the year both as to the quantity of gas to be delivered and to its price. Agreement in principle was reported at yearend, and it is envisaged that pipe shipments from Germany will start in 1970. According to press reports, natural gas delivery from the Soviet Union would start in 1973 at a rate of 580 million cubic meters per year to be increased to 3 billion cubic meters in 1978.[15]

Petroleum.—While there was a slight decline in domestic output of crude petroleum, total shipments and domestic sales of petroleum products continued to increase. Compared with 1968, light fuel oil consumption again showed the largest percentage increase (about 22 percent), to 39 million tons.

West Germany imported 89.55 million tons of crude, 6 percent more than in 1968. Imports from Libya accounted for 45.2 percent of total imports; the Middle East and the Persian Gulf supplied 33.1 percent; Venezuela 4.3 percent; and the U.S.S.R. 3.9 percent. Product imports increased by 19.2 percent, to 25.0 million tons. Crude and product imports were valued at $1,549 million and $606 million, respectively. Stocks of crude oil and finished products, including the contents of pipelines, amounted to 16.2 million tons at yearend. The turnover of the industry producing crude oil and natural gas totaled $250 million and that of the petroleum processing industry totaled $4,860 million. The industry as a whole accounted for 3.9 percent of West Germany's industrial turnover of $128 billion. The industry employed 6,500 in crude oil and natural gas production and 35,000 in petroleum processing. In 1969 taxes and duties provided $2.9 billion revenue.

During the year, West German refineries processed 96,747,800 tons of crude (of which 7,652,300 tons were of domestic origin) compared with a yearend refining capacity of 115 million tons. Refinery utilization was at 85 percent of average capacity. Heating oils (light, medium, and heavy) accounted for 57 percent of total refinery output.

Exploration and Development.—During the year 216,632 meters were drilled (16,678 meters more than in 1968) and 74 wells were completed as follows:

Type of well	Number of holes		Total
	Dry	Producing	
Exploratory	36	5	41
Stepout	7	10	17
Production	2	14	16

The five successful exploratory wells comprised four natural gas discoveries and one oil discovery; the latter was at Gross Lessen in the Weser-Ems area. The four newly discovered natural gasfields are Ruetenbrock in Emsland; Inzenham in Bavaria; Bahnsen in the Hannover area; and Quaadmoor in Weser-Ems area. The Quaadmoor gas deposit is in the Zechstein formation, 9 kilometers south southeast of the Varnhorn gasfield.

[14] Petroleum Press Service. V. 36, No. 10, October 1969, p. 384.
[15] Bulletin de l'Industrie Pétrolière (Paris). No. 1474, Dec. 1, 1969.

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The successful stepout wells included eight gas wells and two oil wells in the following localities:

Gas:		
	Weser-Ems	Hengstlage Nord Z1, Wietingsmoor Z2, Rehden T10, Sagermeer Z3, Sagermeer Z4, and Staffhorst Z4.
	Emsland	Fehndorf T5.
	Bavaria	Oedgassen C5.
Oil:		
	Alpine Foothills	Wald 2.
	Hannover area	Hohnebostel.

West German reserves of crude at year-end totaled 80 million tons (60 million tons measured, and 20 million tons indicated) and of natural 365 billion cubic meters (288 billion cubic meters measured and 77 billion indicated).

Production and Consumption.—The decline in domestic crude output resulted from the natural exhaustion of the older fields. All the oil producing provinces with the exception of Weser-Ems showed slightly decreased output. The Bramberg field, near Lingen, was Germany's most productive field with 811,005 tons, followed by Ruehlemoor with 800,533 tons. It is expected that German crude output may decline gradually to 5.5 million tons by 1974.

Table 11.—Federal Republic of Germany: Petroleum and natural gas production by areas

Area	1967	1968	1969
PETROLEUM, THOUSAND TONS			
North German basin:			
North of Elbe (Schleswig-Holstein)	887	893	883
Between Elbe and Weser	2,388	2,407	2,360
Between Weser and Ems	1,942	1,945	1,954
West of Ems (Emsland)	2,064	2,112	2,092
Upper Rhine Valley	202	192	189
Alpine Foreland (Bavaria)	443	433	398
Total	7,927	7,982	7,876
NATURAL GAS, MILLION CUBIC METERS			
Between Elbe and Weser (Hannover)	60	63	62
Between Weser and Ems (Hannover)	2,499	3,250	4,336
Ems Estuary	-----	1,118	2,050
West of Ems (Emsland)	697	715	883
Upper Rhine Valley	59	48	34
Alpine Foreland (Bavaria)	399	592	823
Total	3,714	5,786	[1] 8,187

[1] Data may not add to totals shown because of independent rounding.

German companies produced 4.6 million tons of crude abroad. The Gelsenkirchener Bergwerks A.G. (GBAG) share in a Libyan concession with Mobil accounted for about 4.5 million tons. Other concessions in Canada, Dubai, Peru, and Algeria produced approximately 148,000 tons.

Petroleum product shipments to the domestic market, including the refineries' own consumption, increased 12.5 percent to 109 million tons. In spite of the increased demand, the index of petroleum prices dropped in 1969 to 89, from 93.6 in 1968 (1962=100). The revaluation of the Deutsche Mark contributed to the price decline.

Refining.—Refining capacity is scheduled to be increased to 171 million tons by 1975 with an effective output of 145 million tons of products. However, this output will not be sufficient to meet consumption demands which may total 154 million tons plus approximately 7 million tons of exports. Refinery output in 1969 totaled 95,966,266 tons.

The 2.5-million-ton increase in refining capacity in 1969 was achieved by expansion of existing refineries among them the following, in million tons: Union Kraftstoff Wesseling 0.8; Saarland-Raffinerie G.m.b.H. 0.75; and Oberrheinische Mineraloelwerke 0.45. Of the total 115-million-ton capacity in 1969, shares of some of the companies were as follows, in percent: Esso A.G., 19.7; Deutsche Shell A.G., 13.9; BP Benzin und Petroleum A.G., 11.9; Gelsenberg-Benzin A.G., 6.1; Oberrheinische Mineraloelwerke, 5.8; Union Kraftstoff Wesseling, 4.9; and Veba-Chemie, A.G., 3.8.[16] The indi-

[16] Erdoel und Kohle-Erdgas-Petrochemie. V. 23, No. 1, January 1970, p. 57.

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Table 12.—Federal Republic of Germany: Shipments of petroleum products
(Thousand metric tons)

Commodity	1967	1968	1969
Domestic sales:			
Gasoline, all kinds	15,343	17,054	18,213
Kerosine, including turbofuel	1,066	1,232	1,421
Diesel oil	7,710	8,488	8,744
Fuel oils	47,923	53,319	61,892
Liquefied petroleum gas	1,674	1,834	2,035
Lube oil and greases	795	891	976
Petroleum coke	390	340	543
Bitumen	3,936	4,315	4,397
Refinery gases	2,043	2,302	2,593
Other products	661	882	1,270
Total	81,540	90,656	[1] 102,083
Consumption by refineries:			
Fuel oil	3,212	3,752	4,271
Refinery gas	1,790	2,173	2,390
Petroleum coke	221	224	212
Total	5,223	6,149	[1] 6,874
Bunker deliveries:			
Gas and diesel oil	745	833	880
Fuel oil	2,578	2,857	3,146
Lubricants	34	37	37
Total	3,357	3,727	4,063
Exports	6,352	7,841	7,478
Other shipments	1,068	1,272	1,451
Changes in refinery stock [2]	+1,050	+1,085	+399
Balancing factor [2] [3]	−2	+79	−273
Total products available [1]	98,587	110,809	122,075

[1] Data may not add to totals shown because of independent rounding.
[2] Plus denotes add; minus denotes subtract.
[3] Apparently changes in nonrefinery stocks.

vidual provinces had the following shares (in percent) in the country's overall refining capacity. North Rhine-Ruhr, 34.4; Upper Rhine-Saar, 24.1; Bavaria, 18.1; Hamburg-Holstein-Bremen, 15.5; and Lower Saxony, 7.9. Of the 34 oil refineries in operation, 13 had processing capacity of 4 million tons and more at yearend.

Work on the expansion and modernization of the Hamburg refinery of Esso A.G. continued. The capacity will be increased from 3.6 to 5.5 million tons annual throughput. Operation of the new units is expected in April 1972. These new units include crude distillation (4.5 million tons annual capacity), vacuum distillation, a power reformer, and installations for desulfurization of gasoline, kerosine, gas oil, and gas.

The Deutsche Erdoel A.G. (DEA) started expansion of its lubricating oil refinery at Grasbrook in the Hamburg free-port area to 400,000 tons annual capacity. The expansion would make the facility one of Europe's largest lubricating oil refineries.

Transportation and Distribution.—West Germany's tanker fleet at yearend consisted of 47 units with a total of 2.4 million tons deadweight. It is estimated that this fleet is capable of supplying approximately 30 percent of the country's petroleum transport requirements.

A percentage breakdown of total crude oil imports in 1969 at ocean terminals was as follows Wilhelmshaven 22.12; Rotterdam 21.25; Trieste 18.20; Marseilles 12.95; Hamburg 11.97; Genoa 7.54; Bruensbuttel 2.51; Emden 2.51; and Bremen 0.95. Total imports of crude oil and products handled by German harbors amounted to 44.07 million tons.

Pipelines delivered 72.63 million tons of crude oil to West German refineries. The remainder of the 89.55 million tons of foreign crude imported were either discharged directly at the processing plants located in the receiving ports or transported to inland refineries by inland tankers or rail tank cars.

BP Benzin und Petroleum A.G. and Esso A.G. announced the formation of a group to study the construction of a pipeline between Wilhelmshaven and Hamburg

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that would supply the Hamburg refineries of the two companies. The pipeline will be 28 inches in diameter and be able to transport 18 million tons of crude annually.

The throughput capacities of the Transalpine Pipeline (TAL) from Trieste to Ingolstadt, as well as that of the Rhein-Donau-Oelleitung from Ingolstadt to Karlsruhe are to be expanded in 1970. With the completion of the new installations TAL will have a capacity in excess of the current level of 24 million tons per year.

At yearend there were 45,850 (830 less than in 1968) stations in West Germany, including West Berlin. The leading companies, together with the number of stations they control or supply, were: Aral 7,260; Shell, 6,090; Esso 5,950; BP 4,790; Texaco 3,250; Gasolin A.G. 3,160; DEA 1,930; Avia 1,170; Fina 970; Total 840; Chevron 820; Stinnes-Fanal 800; Frisia 650, and Agip 560. The reduction in the number of gas stations resulted from the large distributors shutting down uneconomic stations. Some 6,000 stations were operated by cut-price dealers.

Trade.—German imports of crude petroleum and products increased 9.8 percent in volume and 3.5 percent in value. The relatively smaller value increase reflected both price decrease of petroleum in the international markets and the revaluation of the Deutsche Mark in October. Libya was again the leading supplier of crude, followed by Saudi Arabia, Algeria, Abu Dhabi, Iran, Venezuela, and the Soviet Union. The average value of imported crude, calculated at the frontier, was $17.30 per ton.

Well over 50 percent of petroleum products imports was accounted for by light heating oil, 13,445,190 tons. Heavy fuel oil next in importance tonnagewise totaled 3,196,400 tons. The Netherlands and Italy were the main suppliers of light fuel oil, but most of the heavy heating oil imports came from the Netherlands and France.

Compared with 1968, West German exports of petroleum decreased 3.3 percent in volume but showed a 5.3-increase in value. A total of 7.6 million tons of products (including 0.1 million tons of crude oil) valued at $242 million were exported. Heavy fuel oil was West Germany's most important export with the Netherlands as the leading market. Naphtha was the second-ranking petroleum export, with the United Kingdom as the largest market.

Industry Developments.—The German Oil Supply Company was legally established in July with a capital of $12.5 million distributed as follows, in percent: Gelsenberg, Scholven, and Wintershall A.G. 18.5 each; Union Kraftstoff Wesseling 13.5; Deutsche Schachtbau-und Tiebohrungsgeselchaft m.b.H. 10; Saarbergwerke A.G. 9; Preussag A.G. 7; and Deilmann A.G. 5. The objectives of the German Oil Supply Company are to explore for oil in areas outside the EEC, to seek participation in foreign crude producing companies, and to purchase already discovered fields. To carry out these objectives the company will receive about $144 million in Government loans and grants during 1969–74. A contract for the first $12.5 million was signed in July subject to approval by the EEC Commission. The regulations governing this Government assistance provide for conditionally repayable loans of up to 75 percent of expenditures and grants for the acquisition of oilfields or shares in producing companies. The loans or grants will be granted on application and must be used for the specific project proposed after the Government approves the project as feasible.

In addition, the German Unified Oil Supply Company may make long-term contracts for crude oil supply. Such a supply contract between the Company and the Compagnie Française des Pétroles of France for Algerian crudes were discussed during the year.

Together with the French Elf Union-Spafe [17] group, the German Oil Supply Company started its first exploration project off the coast of the Republic of Gabon. The German company also held discussions with a number of integrated oil companies for possible cooperation.

Following discussions between the Government and refining companies, the Government agreed to let the voluntary growth for imports of heavy oil be 7 percent instead of 4 to 6 percent as originally proposed. The voluntary marketing restraint for middle distillates was completely abandoned at the end of 1968.

[17] Elf Union is a subsidiary of France's State-owned Entreprise de Recherches et d'Activités Pétrolières (ERAP). Spafe, Société des Pétroles d'Afrique equatoriale (Gabon-Congo) is also an ERAP subsidiary.

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Shares of GBAG held by the Dresdner Bank and the Deutsche Bank were sold to the Rheinisch-Westfaeliches Elektrizitaetswerke A.G. (RWE). GBAG is the largest German oil company, and RWE is by far the biggest public utility company and, through Rheinische Braunkohlenwerke A.G., have the control of an important refining company, the Union Rheinische Braunkohlen Kraftstoff A.G.

The International Court of Justice at The Hague, the Netherlands, handed down a decision in February on the Continental Shelf boundary dispute between West Germany, the Netherlands, and Denmark. West Germany claimed a greater share of the Continental Shelf than would be the case under the "equidistance" measurement. Without overturning the equidistance principle in marking boundaries, the Court stated that each State has a right only to those areas of the Continental Shelf which constitute the natural prolongation of its territory in and under the sea. The Court instructed the three countries to renegotiate their offshore boundaries according to "equitable" principles. Such negotiations were taking place in the latter part of the year.

Storage.—During the year nine underground caverns, each with 200,000-cubic-meter volume, came into use for crude storage. These caverns were created by leaching a salt plug located northwest of the city of Wilhelmshaven. During the year a fourth cavern was being prepared. The work is carried out by Nord-West Kavernen Gesellschaft m.b.H., formed by a number of oil companies. The estimated cost of the project is $11.25 million.

Underground storage is also being prepared in Bremen-Lesum (two caverns of 150,000 cubic meters each) for Mobil Oil A.G. and at Sottorf near Hamburg-Harburg (six caverns of 200,000-cubic-meter capacity) for Shell. The cities of Kiel, Hamburg, Hannover, and Oberrhein are already using natural caverns for storage of city gas.

Storage capacity of oil tank farms reached 30 million cubic meters at yearend 1968. These include tank farms at oilfields, airports, chemical plants and consumers' installations.[18]

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[18] Petroleum Press Service (London). V. 36, No. 7, July 1969, p. 272.

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The Mineral Industry of Ghana

By Agnes J. Doughman [1]

The new elective Government of Ghana installed in October 1969, inherited a substantially sounder economy than the previous regime but also has the chronic problems of unemployment, underemployment, and foreign debts. The announced policy of the new regime was to encourage foreign investment in sectors requiring high capital investment, technology, and management, which Ghanaians are presently unable to provide. However, the policy contained reservations in some economic sectors for Ghanaian participation in the future. Benefits under the Capital Investments Act of 1963 will not normally be granted on projects outside the reserved sector unless the fixed capital investment is less than $196,000; [2] and 40 percent or more of the equity is held by Ghanaians. Although the Government does not impose Ghanaian participation as a condition for approval of investments over $196,000, indications are that the Government will favor projects which offer Ghanaians capital participation and higher technical and managerial opportunities.

New developments were underway in the bauxite, diamond, and gold industries. Drilling of the first offshore oil well had started at yearend.

Preliminary data indicate a surplus trade balance in 1969 as agricultural products continued to dominate Ghanaian exports; cocoa alone provided over 50 percent of total export value.

PRODUCTION

Ghanaian mine production decreased for the relatively few commodities produced such as bauxite, diamonds, gold, and manganese, which were almost entirely for the export market. However, there was an increase in the output of aluminum, cement, and petroleum products, all of which were processed from imported materials.

[1] Statistical assistant, Bureau of Mines, Washington, D.C.

[2] Where necessary, values have been converted from Ghanaian currency to U.S. dollars at the rate of 1 new Ghana cedi = US$0.98.

Table 1.—Ghana: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Aluminum:			
Bauxite	350,961	284,705	269,502
Metal	39,702	108,902	113,109
Gold, troy ounces	762,609	727,122	706,621
Iron and steel, steel semimanufactures •	12,000	12,000	7,360
Manganese ore and concentrate	498,389	413,329	349,698
Silver, troy ounces	-------	-------	2,649
NONMETALS			
Cement	NA	230,440	407,513
Diamond:			
Gem, thousand carats	254	• 245	• 238
Industrial, do	2,283	• 2,202	• 2,144
Total, do	2,537	2,447	2,382
Salt	35,820	• 29,000	35,923
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline, aviation and motor, thousand 42-gallon barrels	1,219	1,185	1,353
Kerosine and jet fuel, do	692	r 457	474
Distillate fuel oil, do	1,397	1,456	1,613
Residual fuel oil, do	1,555	r 2,012	2,305
Other, do	286	39	37
Total, do	5,149	r 5,149	5,782

• Estimate. r Revised. NA Not available.

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TRADE

With the exception of a change in the trade pattern of aluminum and cement since the aluminum smelter and a second cement plant have been in operation, Ghana's trade remained at about the same level.

Table 2.—Ghana: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite	800,439	241,000
Metal, including alloys, unwrought	39,582	76,705
Gold, metal, unworked or partly worked.....thousand troy ounces	767	735
Iron and steel, metal, scrap	3,103	-------
Manganese ore and concentrate	452,457	445,900
Nonferrous metal scrap, n.e.s	1,056	3,105
NONMETALS		
Diamond, all grades.....thousand carats	1,990	2,997
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude and partly refined.....thousand 42-gallon barrels	(1)	-------
Refinery products:		
Distillate fuel oil.....do	8	-------
Residual fuel oil.....do	1,522	1,379

[1] Less than ½ unit.

Major destinations of selected commodities, 1968

(Metric tons unless otherwise specified)

Commodity	Quantity
METALS	
Bauxite, total	241,000
United Kingdom	169,402
Manganese ore and concentrate, total	445,900
Norway	199,651
United States	73,789
Canada	53,138
NONMETALS	
Diamond, all grades, total thousand carats	2,997
United Kingdom.....do	1,670
Netherlands.....do	620
Belgium-Luxembourg.....do	554

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Table 3.—Ghana: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Oxide and hydroxide	116,515	691,744
Metal, including alloys:		
Unwrought	394	237
Semimanufactures	2,053	1,865
Copper, metal, including alloys, all forms	412	464
Gold, metal, unworked or partly worked, troy ounces	610	2,500
Iron and steel:		
Metal:		
Pig iron, ferroalloys and similar materials	682	1,399
Steel, primary forms	332	122
Semimanufactures	35,886	38,240
Lead, metal, including alloys, all forms	386	160
Platinum-group metals and silver:		
Metal, including alloys, troy ounces	161	20,327
Tin, metal, including alloys, all forms, long tons	144	107
Zinc, metal, including alloys, all forms	892	36
NONMETALS		
Cement:		
Clinker	128,504	249,946
Portland and other	305,317	84,910
Clay and clay products (including all refractory brick):		
Crude clays, n.e.s.	505	378
Products	3,039	2,473
Fertilizer materials:		
Crude	338	351
Manufactured	322	5,011
Gypsum and plasters	5,647	7,821
Lime	3,395	3,560
Salt and brines	139	432
Sodium and potassium compounds, caustic soda	3,065	6,967
Stone, sand and gravel	6,103	1,252
Sulfur:		
Sulfur and unroasted iron pyrites	320	50
Sulfuric acid	598	867
Talc, steatite, soapstone, and pyrophyllite	883	3,159
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets, thousand tons	30	[1] 23
Gas, hydrocarbon, 42-gallon barrels	448	NA
Petroleum:		
Crude and partly refined, thousand 42-gallon barrels	5,709	6,270
Refinery products:		
Gasoline, do.	16	78
Kerosine and jet fuel, do.	201	147
Distillate fuel oil, do.	43	50
Lubricants, do.	131	105
Other, do.	r 293	454
Total, do.	r 684	834
Mineral tar and other coal-, petroleum-, or gas-derived crude minerals	188	163

r Revised. NA Not available.
[1] Adjusted by Bureau of Mines.

Major origins of selected commodities, 1968

(Metric tons unless otherwise specified)

Commodity	Quantity
METALS	
Aluminum oxide and hydroxide, total	691,744
United States	691,734
NONMETALS	
Cement, clinker, total	249,946
Norway	249,946
MINERAL FUELS AND RELATED MATERIALS	
Petroleum, crude and partly refined, total thousand 42-gallon barrels	6,270
Iran, do.	2,209
Aden, do.	1,536
Jordan, do.	1,417
U.S.S.R., do.	972

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COMMODITY REVIEW

METALS

Aluminum.—The Volta Aluminum Co. Ltd. (VALCO) announced a $24 million expansion program to increase annual capacity of the Tema smelter from about 110,000 metric tons to 147,000 tons. Construction is scheduled for completion by mid-1971 to coincide with announced plans for expansion of electrical generating capacity of the Akosombo powerplant operated by the Volta River Authority (VRA), an agency of the Ghanaian Government. Under a power sales agreement VRA is committed to furnish the additional power required by VALCO.

Bauxite.—Production declined in 1969 as the British Aluminum Co. Ltd., experienced difficulties in rail transportation to the port. British Aluminum continued to work the deposits at Kanaiyerebo, and in late 1968, started production at the 20-million-ton Ichiniso deposit near existing mines at Awaso. The new plant scheduled to replace facilities at Awaso was put into operation early in 1969.

At midyear, Kaiser Aluminum & Chemical Corp., operator of the VALCO aluminum reduction plant at Tema, conducted an exploration program to determine the quantity and grade of available bauxite reserves. If adequate reserves are available, Kaiser would consider constructing an alumina plant to supply raw material for the Tema smelter. Production of 250,000 metric tons annually would be required. The Atiwa Range deposit near Kibi, which contains an estimated 70 million metric tons of high-grade ore, was found to be best suited for the purpose. It would probably be 5 to 7 years before deposits could be developed and a plant put in operation.

An estimated 170–200 million metric tons of bauxite, including 130 million tons of high-grade ore, is known in the Nyinahin area.

Representatives of the Japan Aluminum Smelters Association examined bauxite reserves to study the economics of developing deposits and shipping bauxite to Japan or the construction of alumina facilities in Ghana. No decision had been reported at yearend.

Gold.—In 1969 the gold mining industry experienced violent strikes and disorders. In March workers at the Ashanti Goldfields at Obuasi went on strike to support their demands for payment of funds accumulated under the ownership and operation of Ashanti Goldfields Corp. Ltd. The workers argued that payment was due in February when Lonrho Ltd. took over the operations from Ashanti. The claim was based on the workers interpretation of the Labor Decree's provision requiring severence pay for workers when firms are closed, reorganized, or amalgamated. An agreement was reached to grant 3 months pay as a good will award to each Ashanti employee. In June strikes at mines operated by the State Gold Mining Corp. led to violence when workers demanded salary increases and improved working conditions. The employees agreed to return to work on the promise that their demands would be negotiated by the Ghana Trades Union Congress and the National Executive of the Mine Workers' Union.

Despite the March 1-week strike, Ashanti milled 619,000 tons of ore to produce a record 486,000 ounces of gold. The 7-year expansion plan at the Obuasi mine is now in its third year. When development of the new General Spears shaft is completed, production is expected to increase substantially.

Iron Ore.—The two major iron deposits were reported to contain ore ranging from 40 to 55 percent iron. The exploitable reserves at Shieni are an estimated 270 million tons.

Manganese.—The Director of the Geological Survey Department announced near yearend that a Japanese manganese survey team was interested in Ghanaian deposits containing 30 to 40 million tons of low-grade manganese.

NONMETALS

Diamond.—Ghana's largest diamond producer, Consolidated African Selection Trust, Ltd. (CAST), continued mining at Akwatia. CAST was investigating the feasibility of large-scale dredging operations in the Birim River, but results were not reported. Lonrho Ltd. also was granted permission for diamond prospecting in the Birim basin, work to be by dredging of the river channel.

The State Diamond Marketing Corporation considered authorizing commercial

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banks to resume the purchase of diamonds in order to encourage private diggers to increase production.

Limestone.—A proposal was made for construction of facilities near Half Assini to supply lime to the two cement plants. Limestone from nearby deposits at Nauli would probably be used.

MINERAL FUELS

Petroleum.—The Ministry of Land and Natural Resources granted prospecting licenses for all the offshore blocks and two of the onshore blocks remaining unallocated at the December 1968 deadline. All of the blocks were assigned to oil companies previously granted prospecting licenses. The Israel National Oil Co. Ltd. received Blocks 1, 2, 34, and 35; Mobil Exploration Ghana Inc., Blocks 3 and 3-A; Jack Grynberg and Associates, Block 17; and Frontier Ghana Oil Ltd., Blocks 18 and 18A. At yearend onshore Blocks 27 to 33 remained unallocated.

Following granting of the first concessions, various groups have conducted seismic surveys throughout the exploration area. Blocks 15 and 16 held by Jack Grynberg and Associates were placed on a farmout to Chevron Oil Company (Ghana). Chevron made an agreement with Signal Oil and Gas Co., Occidental Petroleum Corp., and Amoco Ghana Exploration Co., in which the Signal group would acquire a 75-percent interest in each block by drilling the first wildcat in Block 15. Drilling was underway by yearend and a second well is scheduled for early 1970.

In early 1969 the Soviet Union defaulted on a contract to deliver 700,000 tons of crude oil to the Tema refinery in the year starting September 1, 1968. During March–July, the marketing companies in Ghana were again called on to supply varying quantities of crude oil to the refinery. For August–December, Shell was the only supplier, providing 108,000 tons of crude oil. This time the marketing companies were not obligated to dispose of the surplus fuel oil produced at the refinery. Some fuel oil was exported; however, Ghana plans to establish an asphalt unit to reduce surplus fuel oil output.

Bids were invited in November for the 1970 supply of 900,000 tons of crude oil, with a wide range of gravity and low sulfur content, for the Tema refinery. Bidders were not obligated to dispose of surplus fuel oil. In December the Soviet Union was awarded a 500,000-ton contract. The remainder was to be supplied by Latsis, a Greek trading company.

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The Mineral Industry of Greece

By Bernadette Michalski [1]

Expanded output of alumina, aluminum, chromite, ferronickel, magnesite, and lignite contributed significantly toward the 11.3-percent increase in industrial production recorded in 1969. The industrial production increase in the previous year was 6.5 percent, and in 1967 merely 3.3 percent. Average industrial wages and salaries rose by 10 percent and industrial employment rose by 2.5 percent in 1969. The development of a favorable climate for foreign investors, has in 1969 added at least three American oil drilling firms to the foreign investors roster.

Investments in mineral exploration and development adopted in the current economic plan (1968–72) will yield a steadily increasing mineral ouput. In the mining industry alone, capital investment during 1970–71 is scheduled at $46 million.[2] Heavy investments in petroleum refining, thermal power generation, and alumina-aluminum production were under negotiation at yearend with potential investment in this area totaling $800 million.

PRODUCTION

Many segments of the mineral industry made appreciable gains in 1969. Noteworthy among these achievements were the opening of at least two additional bauxite mines in 1969; the expansion of capacity at the Antykira Bay aluminum refinery; the re-opening of the Skoumtsa metallurgical-grade chromite mine; expanded ferronickel operations at the Larymna mines and smelter; the expansion of the magnesite industry at Mantoudi; and the expansion of lignite mining operations at Ptolemais and Megalopolis.

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[1] Foreign mineral specialist, Bureau of Mines, Washington, D.C.

[2] Where necessary, values have been converted from Greek Drachma (Dr) to U.S. dollars at the rate of GDr1.00=US$0.0333.

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Table 1.—Greece: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
METALS				
Aluminum:				
Bauxite, gross weight	thousand tons	1,659	1,750	1,940
Alumina, gross weight	do.	e 175	e 225	285
Metal, primary		72,000	76,000	80,000
Chromite		12,000	13,000	30,000
Iron and steel:				
Iron ore and concentrate		17,000	12,000	------
Pig iron	thousand tons	NA	NA	290
Steel ingots and castings	do.	160	218	e 250
Steel semimanufactures	do.	380	400	450
Lead:				
Concentrate, metal content		9,750	9,750	8,580
Metal, primary		6,537	8,861	11,600
Manganese concentrate [1]		7,752	6,744	6,384
Nickel:				
Mine output, metal content		2,158	3,735	5,200
Ferronickel, (28 to 30 percent nickel cobalt)		9,149	14,104	18,473
Metal, electrolytic		NA	264	e 300
Silver, metal	thousand troy ounces	238	267	258
Zinc concentrate, metal content		10,400	10,611	9,215
NONMETALS				
Abrasives, emery		7,600	7,600	7,100
Barite, refined	thousand tons	64	65	76
Cement, hydraulic	do.	3,450	4,000	4,831
Clays:				
Bentonite	do.	120	180	200
Kaolin	do.	70	70	60
Fertilizers, manufactured:				
Nitrogenous	do.	700	220	293
Phosphatic	do.		790	648
Gypsum and anhydrite	do.	210	215	235
Magnesite:				
Crude	do.	425	400	580
Dead burned	do.	100	100	169
Caustic calcined	do.	35	28	51
Perlite	do.	120	129	150
Pumice	do.	350	283	386
Pyrite:				
Gross weight	do.	180	210	245
Sulfur content	do.	84	98	114
Salt, all types	do.	95	99	75
Stone dimension, marble	do.	150	152	184
Talc		5,000	4,500	4,500
MINERAL FUELS AND RELATED MATERIALS				
Coal, lignite	thousand tons	5,000	5,600	6,800
Fuel briquets, lignite briquets	do.	100	100	90
Gas, manufactured	million cubic feet	NA	335	343
Petroleum refinery products:				
Gasoline and naphthas:				
Motor gasoline	thousand tons	401	465	478
Naphthas	do.	NA	102	99
Kerosine and jet fuel:				
Kerosine	do.	104	89	100
Jet fuel	do.	266	325	374
Distillate fuel oils	do.	1,096	1,313	1,242
Residual fuel oil	do.	1,706	1,753	1,832
Liquefied petroleum gas	do.	54	61	70
Lubricants	do.	NA	12	14
Asphalt and bitumen	do.	65	76	89

e Estimate. p Preliminary. NA Not available.

[1] Virtually all battery grade.

TRADE

Unofficial sources indicate that exports by Greece's mining and metallurgical enterprises have shown spectacular growth since 1966, more than doubling to about $110 million in 1969. Included in this total are ores and processed products, other than alumina and aluminum, from 16 leading mining companies, valued at $66.8 million. Alumina and aluminum accounted for much of the remainder. The rapid growth in exports is largely attributed to development of the nonferrous metal industry and bauxite and nonmetallic mineral mining. In 1968 mineral commodities valued at about $90 million accounted for 19 percent of Greece's total commodity exports as compared with 16 percent in 1967. The European Economic Community (EEC) remained Greece's principal market receiving nearly $50 million or 55 percent of the mineral exports.

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Mineral commodity imports were valued at $218.3 million in 1968 or 16 percent of total imports. Crude petroleum, petroleum products and iron and steel constituted the bulk of mineral imports. Liquid fuels comprised 42 percent of all mineral imports, or $92.3 million, while iron and steel, excluding iron ore, accounted for 30 percent of $64.6 million. The EEC continued as the principal source for mineral commodity imports, supplying in 1968 about $95 million by value of which $45 million was in iron and steel.

Table 2.—Greece: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum:			
Bauxite and concentrate—thousand tons	1,132	1,190	U.S.S.R. 457; West Germany 331; United Kingdom 98.
Oxide and hydroxide—do	43	73	NA.
Metal, including alloys:			
Unwrought	59,917	63,702	France 23,575; Belgium-Luxembourg 16,514; United States 12,380.
Semimanufactures	2,200	1,650	Italy 1,102.
Chromite	18,439	15,331	All to West Germany.
Copper:			
Matte	159	NA	NA.
Metal, including alloys:			
Scrap	-------	1,696	All to West Germany.
Semimanufactures	1,338	1,494	France 620; West Germany 319; Hungary 205.
Iron and steel:			
Roasted pyrite	58,403	34,720	West Germany 11,820.
Steel, primary forms	7,174	19,101	Spain 13,412; United States 938.
Semimanufactures:			
Universals, plates, and sheets	1,901	6,618	Yugoslavia 6,159.
Tubes, pipes, and fittings	779	808	Cyprus 438.
Lead, ore and concentrate	11,113	13,167	France 6,790; Italy 6,077.
Manganese ore and concentrate	6,517	6,010	West Germany 3,640.
Nickel metal, including alloys, all forms	7,040	75	All to Italy.
Zinc:			
Ore and concentrate	24,331	15,073	France 10,368; West Germany 2,000.
Metal, including alloys, all forms (scrap)	-------	82	NA.
Other, ash and residues containing nonferrous metals	1,540	948	Spain 344.
NONMETALS			
Abrasives, natural, n.e.s:			
Pumice, emery, natural corundum, etc	120,707	190,639	NA.
Cement	353,920	344,461	Libya 298,954; Yugoslavia 32,608.
Clay and clay products:			
Crude clays, n.e.s	118,527	139,176	NA.
Products:			
Refractory (including nonclay bricks)	1,675	1,862	NA.
Nonrefractory	1,670	1,860	NA.
Fertilizer materials, manufactured:			
Phosphatic	40,225	84,358	All to Bulgaria.
Other	20,000	56,452	Bulgaria 28,220; Yugoslavia 24,432.
Magnesite	148,224	174,829	NA.
Pyrite (gross weight)	4,328	4,037	NA.
Stone, sand and gravel:			
Dimension stone, crude and partly worked	24,586	26,983	NA.
Other	1,061	NA	NA.
Sulfur, elemental	7,797	23,137	United Arab Republic 8,074; Hungary 7,628; Turkey 2,377.
Other nonmetals, crude	86,345	167,969	United States 51,688; West Germany 28,863; United Kingdom 25,301.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline, including natural	27,958	37,405	Cyprus 13,225; United Kingdom 12,919; Netherlands 9,877.
Kerosine and jet fuel	88,350	141,804	Lebanon 79,672; United Arab Republic 25,588; Netherlands 14,444.
Distillate fuel oil	50,663	61,452	West Germany 35,935; Cyprus 15,622; United States 4,006.
Residual fuel oil	72,563	13,895	NA.
Lubricants	759	NA	NA.

NA Not available.

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Table 3.—Greece: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum metal, including alloys:			
Unwrought	2,459	1,624	Canada 591; Austria 423; United States 219.
Semimanufactures	1,122	1,187	West Germany 467; Italy 334; France 169.
Arsenic trioxide, pentoxide, and acids	151	NA	NA.
Chromium oxide and hydroxide	153	-------	
Copper:			
Ore and concentrate	1,596	NA	NA.
Metal, including alloys:			
Unwrought:			
Blister and other unrefined	8,618	8,978	Zambia 4,532; Congo (Kinshasa) 2,355; Belgium-Luxembourg 877.
Refined			
Semimanufactures	487	512	Italy 179; West Germany 134; France 39.
Iron and steel:			
Ore and concentrate	178,058	368,747	Algeria 144,897; Liberia 113,451; Tunisia 110,358.
Metal:			
Pig iron, including cast iron	27,748	32,986	U.S.S.R. 11,082; West Germany 8,457; East Germany 8,094.
Ferroalloys:			
Ferromanganese	783	992	NA.
Other	1,113	963	NA.
Steel, primary forms, thousand tons	49	145	France 55; Belgium-Luxembourg 53; Republic of South Africa 11; Japan 11.
Semimanufactures:			
Bars, rods, angles, shapes, sections, do	161	163	West Germany 48; Belgium-Luxembourg 41; France 40.
Universals, plates, and sheets, do	159	139	West Germany 27; Belgium-Luxembourg 27; United Kingdom 21.
Hoop and strip, do	77	40	Belgium-Luxembourg 18; West Germany 11; France 5.
Rails and accessories, do	8	6	France 2; Belgium-Luxembourg 2.
Wire, do	6	8	West Germany 3; United Kingdom 2; Belgium-Luxembourg 1.
Tubes, pipes, fittings, do	15	16	West Germany 7; France 2; United Kingdom 2; Italy 1.
Castings and forgings, rough, do	2	2	United States 1.
Lead:			
Ore and concentrate	8,289	9,466	Morocco 7,045; Algeria 2,421.
Oxides	950	NA	NA.
Metal, including alloys:			
Unwrought	2,340	2,602	Mexico 1,097; Republic of South Africa 668; United Kingdom 321.
Semimanufactures	132	154	NA.
Mercury, 76-pound flasks	348	NA	NA.
Nickel metal, including alloys, all forms	74	41	Mainly from West Europe.
Platinum-group metals and silver, including alloys:			
Platinum group, value thousands	$1	$49	NA.
Silver, do	$300	$292	West Germany $196.
Tin metal, including alloys, all forms, long tons	215	316	Malaysia 111; Netherlands 94; Switzerland 60.
Titanium oxides	2,418	NA	NA.
Tungsten metal, including alloys, all forms, value thousands	$80	NA	NA.
Zinc metal, including alloys:			
Unwrought	7,498	7,275	Belgium-Luxembourg 3,081; Zambia 1,411; West Germany 946.
Semimanufactures	237	329	NA.
Other base metals, including alloys, all forms	117	86	NA.
NONMETALS			
Abrasives, natural, n.e.s:			
Pumice, emery, natural corundum, etc.	153	NA	NA.
Grinding stones	288	230	Mainly from West Europe.
Asbestos	5,514	8,465	Canada 3,739; Republic of South Africa 2,220; U.S.S.R. 1,541.
Cement	1,100	1,156	NA.
Clay and clay products (including all refractory brick):			
Crude clays, refractory	22,427	29,694	United Kingdom 20,537; West Germany 3,512; Italy 1,894.
Products:			
Refractory (including nonclay bricks)	15,007	19,440	West Germany 6,570; Israel 3,268; Austria 2,437; United Kingdom 2,109.
Nonrefractory	8,078	5,337	Italy 4,007; United Kingdom 458.

See footnote at end of table.

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Table 3.—Greece: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS—Continued			
Diatomite and other infusorial earths	1,389	NA	NA.
Feldspar and fluorspar	1,491	NA	NA.
Fertilizer materials:			
Crude:			
Nitrogenous	969	40	NA.
Phosphatic—thousand tons	332	394	Tunisia 163; Morocco 138; Senegal 81.
Manufactured:			
Nitrogenous—do	140	135	Bulgaria 66; Italy 22; France 16; West Germany 11.
Phosphatic—do	18	NA	NA.
Potassic—do	18	25	France 9; Italy 6; East Germany 5.
Other, including mixed—do	43	6	West Germany 4.
Ammonia—do	15	NA	NA.
Graphite, natural	260	NA	NA.
Gypsum and plasters	758	NA	NA.
Magnesite	394	NA	NA.
Mica:			
Crude, including splittings and waste	22	NA	NA.
Worked, including agglomerated splittings	9	NA	NA.
Precious and semiprecious stone, except diamond, synthetic—value thousands	$82	NA	NA.
Sodium and potassium compounds:			
Caustic soda	29,036	NA	NA.
Caustic potash	226	NA	NA.
Sulfur:			
Elemental, all forms	42,900	100,297	France 65,109; Poland 20,070; Canada 15,075.
Sulfur dioxide	NA	NA	NA.
Sulfuric acid	22,351	NA	NA.
Talc, steatite, soapstone, and pyrophyllite	1,327	NA	NA.
Other nonmetals, n.e.s.:			
Crude	211	NA	NA.
Oxides and hydroxides of magnesium, strontium, and barium	48	NA	NA.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals	367	6,920	Bulgaria 2,031; West Germany 1,786; Yugoslavia 1,248.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	952	NA	NA.
Coal, all grades, including briquets—thousand tons	116	75	U.S.S.R. 47; Poland 20; West Germany 2.
Coke and semicoke—do	123	212	West Germany 156; Czechoslovakia 37; Italy 14.
Gas, natural	14,891	24,130	Italy 15,145; Rumania 6,538; France 2,248.
Petroleum:			
Crude and partly, refined—thousand tons	3,992	3,852	Saudi Arabia 1,879; Iraq 1,315; U.S.S.R. 580.
Refinery products:			
Gasoline, including natural—do	97	81	Rumania 36; Italy 19; U.S.S.R. 15.
Kerosine and jet fuel—do	16	12	Italy 7.
Distillate fuel oil—do	457	289	Italy 105; U.S.S.R. 61; Rumania 53; Netherlands Antilles 39.
Residual fuel oil—do	591	693	U.S.S.R. 243; Rumania 166; Italy 163; France 71.
Lubricants—do	43	49	France 19; Italy 12; Netherlands 11.
Other:			
Petroleum coke—do	28	48	United States 32; France 9; West Germany 6.
Other—do	8		

NA Not available.

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COMMODITY REVIEW

METALS

Aluminum.—Two of Greece's principal bauxite producers, Parnassos Bauxite, S.A., and Eleusis Bauxite S.A., were engaged in major expansions of exploration, mining, drying, and shipping operations during 1969 in an attempt to meet raw material requirements for the expanding domestic alumina-aluminum industry while maintaining bauxite export markets. Parnassos Bauxite S.A. conducted extensive exploratory drilling operations at its Parnassos and Ghiona mines and plans to modernize ore handling and storage facilities including possibly constructing a concentrator to upgrade lower quality ore. In addition to modernizing mining operations at its major deposits in the Mandria-Eleusis region, Eleusis Bauxite S.A. has accelerated development of its recently discovered deposits at Kokkinovrachos on Mt. Oiti and the Chrisso deposit in the Ghiona region.

The Kokkinovrachos deposit is the largest uninterrupted low-iron, low-calcium bauxite deposit in Greece. Reserve estimates are placed at 4 million tons. Open pit mining operations here yielded nearly 100,000 tons of bauxite in 1969. Exploitation will be by underground methods by 1972, when an annual output of 300,000 tons of ore is planned. Construction of a mechanical shiploading bridge of 1,000-ton-per-hour capacity was underway at port facilities near Kokkinovrachos, with operation scheduled by the fall of 1970.

The Chrisso deposit reserve is estimated at 5 million tons of boehmitic ores. Exploitation commenced in 1968, yielding 50,000 tons that year. Output from the deposit approached 100,000 tons in 1969.

Hellas Mining Co., S.A. also expanded mining operations and purchased additional bauxite handling and shipping equipment during the year.

Bauxite consumption by Greece's sole primary aluminum producer, Aluminum de Grèce, S.A. (ADG), was estimated at 650,000 tons in 1969. Delphi Bauxite Mines, S.A., owned partly (50 percent) by ADG, and the only Greek bauxite producer associated in the vertical structure of an alumina-aluminum producer, supplied less than one-third of ADG's bauxite requirement; the balance was derived from independent Greek bauxite producers. The remaining bauxite output, about 1.3 million tons, was exported principally to the U.S.S.R. and West German markets.

The Antykira Bay alumina-aluminum plant of ADG operated at full capacity in 1969. Additional alumina produced above domestic smelter consumption requirements (approximately 115,000 tons) and about 75 percent of aluminum ingot output (or 60,000 tons) was exported. ADG has accelerated expansion activities during 1969; plans call for a 45-percent increase in annual alumina production capacity in 1970 to 450,000 tons and a 12-percent increase in annual aluminum ingot capacity to 90,000 tons at the same time. Further expansion activities were programed for 1970 to raise ADG's total annual capacity to 475,000 tons alumina and 150,000 tons aluminum by 1971.

Negotiations between the Government and private Greek investors regarding investment in a major industrial development scheme including alumina-aluminum facilities were still underway at yearend. The proposed 500,000-ton-annual-capacity alumina plant and a 160,000- to 250,000-ton-annual-capacity aluminum plant is part of a proposed industrial complex at Megara which would include a 7.5-million-ton-annual-capacity petroleum refinery and a thermal electric power station of 1,080- to 1,440-megawatt capacity. The first phase, or 50 percent of the final capacity of the alumina-aluminum plant, was to be constructed within 3½ years and the final phase was to be completed within 7 years of the effective date of the investment agreement.

While utilization of domestic bauxite is a major objective in the investment program, Greece's independent bauxite producers will be in competition with other world producers as the final agreement will probably give preference to Greek bauxites only if they are offered in acceptable quantity and quality and at prices equal to or lower than international c.i.f. prices.

Chromite.—Improved chromite market prices prompted the reopening of the Skoumtsa metallurgical-chromite mine in the Kozani area. By yearend, output

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reached capacity level of 15,000 tons concentrate containing 54 percent Cr_2O_3, 11 percent Fe, 4 percent SiO_2, 9 percent Al_2O_3 and 16 percent MgO.

The refractory-grade chromite mining operations at Tsangli, producing an estimated 13,000 tons of concentrate in 1968, were continued, probably yielding a greater output in 1969 to take advantage of the favorable market.

Copper.—The Hellenic Chemical Products and Fertilizers Co. reported discovery of a 2-million-ton chalcopyrite-pyrite ore body in the Vathilakkos deposits on the Chalkidhiki peninsula. A $28 million contract was awarded the Roberts Construction Company Ltd. of Johannesburg for construction of 1,200-foot vertical shaft, two 500-foot inclined shafts, and other underground workings. Ore extraction tenders were received from East Europe, the United Kingdom, the Republic of South Africa, and West Germany, but no contract decision was announced by year-end.

Iron and Steel.—The steel industry, operating at less than 50 percent of capacity, continued to produce a limited variety of steel products, many of which were sustained by protective tariffs levied on potentially more competitive foreign imports. In an attempt to attain economic viability in the domestic industry the Greek Government has requested a feasibility study on the steel industry with emphasis on the proposed expansion of the Hellenic Steel Company's Thessaloniki plant. The proposed expansion would raise the plant's annual capacity from a 1969 level of 300,000 tons of cold-rolled products to 1.5 million tons of a full range of steel products. The expansion would involve an investment equivalent of $125 million.

Uranium.—Government-sponsored uranium exploration continued in northern Greece. The $1.5 million dollar equivalent exploration program covers a 4-year period with the charting of the sedimentary basins at Kotyli and Xanthis scheduled for completion in 1969.

Preparations were underway at the Democritus Nuclear Research Center for the construction of a nuclear reactor representing an investment estimated at $2 million. Contracts for the purchase of the 11-megavolt accelerator were placed in the Netherlands and the United States.

NONMETALS

Asbestos.—Exploration by the General Mineral Exploration and Mining Development Corp., a subsidiary of the Hellenic Industrial Development Bank (HIDB), outlined a deposit of 15 million tons of chrysotile asbestos ore near Kozani in northwestern Greece. Hellenic Asbestos, an operating company of HIDB, may undertake deposit development and mill construction with a proposed annual yield of 30,000 tons of short fibre asbestos.

Fertilizers and Fertilizer Materials.—Domestic production accounted for more than two-thirds of the nation's manufactured fertilizers requirement. In a move to achieve greater self-sufficiency and a diversification of fertilizer types, Greece's leading fertilizer producers have launched programs aimed at expansion of existing facilities and construction of additional plants. Among these programs is the expansion of the Ptolemais fertilizer plant contracted to a West German consortium by the Nitrogenous Fertilizers Industry, S.A. At a total cost of $6 million, plant capacity will be increased by 50 percent, attaining an annual production capacity of 50,000 tons of contained nitrogen by 1971. The contract also includes installation of a 7-million-cubic-foot ammonia gas synthesis unit, and dependent upon company requirements, the plant will have an annual capacity of 145,000 tons of ammonium nitrate (34.5 percent nitrogen) or 192,000 tons of calcium ammonium nitrate (26 percent N).

Northern Greece Chemical Industries, S.A., completed a 65,000-ton-per-year capacity nitric acid plant and an 85,000-ton-per-year capacity ammonium nitrate plant at Thessaloniki in October 1969.

Hellenic Chemical Products and Fertilizers Co. has replaced two existing phosphoric acid units by a single larger unit at its Drapetsona plant, as well as expanded its N–P–K complex fertilizer unit. Additional investments were made for storage and packing facilities at the plant, raising total investment to $11.3 million.

The Greek Government approved plans submitted by Phosphoric Fertilizers Industry Ltd. for establishment of complex fertilizer production facilities at the Nea Karvali plant at a cost of $33 million.

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Magnesite.—The significant increase in magnesite production was attributable to expanded mining operations and additional dead-burned kiln capacity at the Mantoudi deposit on Euboea Island, operated by Société Financière de Grèce, S.A. Total kiln capacity was reported at 100,000 tons after the installation of a third rotary kiln in 1968. Technical improvements in all three kilns, however, increased total dead-burned magnesite capacity to 140,000 tons in 1969, with actual production reported at 119,000 tons for the year. Production from a fourth rotary kiln is planned in 1970. This kiln, valued at $2 million, will bring total annual kiln capacity to 200,000 tons.

A new magnesite dressing unit was commissioned in 1969 at Paraskevorema near Mantoudi with a 100,000-ton-per-year capacity, bringing total dressing capacity at Mantoudi to 400,000 tons.

Salt.—Construction of a 630,000-ton-annual-capacity solar salt facility was undertaken near Messolonghi lagoon. At a later date, facilities for the annual production of 30,000 tons of refined salt, 60,000 tons of sodium sulfate, and 25,000 tons of hydrated lime will be added.

MINERAL FUELS

Lignite.—Expanded operations at the Megalopolis and Ptolemais mines were major factors in the lignite industry's 22-percent increase in production over the previous year. The electric power industry consumed about 85 percent of the 1969 lignite output, nitrogenous fertilizer manufactures consumed about 10 percent and the remaining supply was consumed in briquet manufacture and domestic heating. Increasing demands for electric power have prompted mine mechanization and development activities which should yield on anticipated 10 million tons in 1970 and 15 million tons by 1972.

Petroleum.—While Texaco Overseas Petroleum Co. launched offshore exploratory studies in the Thermaic Gulf with plans to spud in a well early in 1970, the Greek Government entered into negotiation with three additional U.S. firms for offshore exploratory contracts. An-Car Hellenic Oil Co., a subsidiary of An-Car Oil Co. (Boston, Mass.), received a 10,000-square-kilometer concession near Zakinthos, Cephatonia, and Kylline Islands in the Ionian sea, with an investment commitment of $4.5 million in a 5-year period. Ada Oil Exploration Corp. (Houston, Tex.) was awarded a 4,000-square-kilometer concession near Limnos Island with an investment commitment of $7.2 million for geophysical and exploratory drilling within a 5-year period. Oceanic Exploration Corp. was awarded an exploration concession, in an 8,000-square-kilometer area off the coast of Thrace with an investment commitment of $5 million.

Although the refining industry, based entirely on imported crudes, processed about 4.5 million tons of petroleum in 1969, product imports approached 2 million tons emphasizing the necessity for expanding Greek refining facilities. Contracts for expansion of existing facilities and the construction of a third major refinery were under negotiation. The proposals included the expansion of the State-owned 1.8-million-ton-annual-capacity Aspropyrgos refinery and the 2.7-million-ton-annual-capacity Esso-Pappas refinery in Thessaloniki as well as the construction of a third refinery of 7.5- to 10-million-ton annual capacity. The expansion and construction concessions were an integral part of a complex industrial investment package with Aristotle Onassis and Stavros Niarchos as principal investors.

A contract for the management and operation of the Aspropyrgos Government-owned refinery was awarded to Omega Petroleum, S.A. (Aristotle Onassis), on February 13, 1969. However, the contract may be terminated if the Stavros Niarchos interests should gain equity in the plant.

The Seka Corp. (Greek) announced construction of a $17 million lubricants plant. The project is scheduled for completion in 1972 with a 75,000-ton-annual capacity, which will be more than sufficient to satisfy Greek consumption.

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The Mineral Industry of Hungary

By Joseph B. Huvos [1]

Hungary produces few minerals; only bauxite was significant by world production standards in 1969. The production of mineral fuels, iron, and steel was important only for Hungary's domestic economy. Substantial imports were necessary to satisfy demand for most minerals except bauxite and low-rank coals.

Major events in 1969 included allocation of $23 million[2] for construction of two new bauxite mines, a $15 million credit agreement with a western banking consortium to purchase modern machinery for the aluminum industry, further concentration of Hungary's coal industry, a startup of production of the Visonta opencast lignite mine and of a 100-megawatt generating unit, and increased production of crude oil and natural gas in the Szeged region.

PRODUCTION

Production of brown coal (lignite), Hungary's most important mineral, declined slightly because of the closing of smaller and inefficient mines. The production of bauxite, Hungary's most important export mineral, remained approximately the same. Increasing oil production from the Szeged-Algyö region compensated for decreasing output in southwest Hungary.

[1] Foreign mineral specialist, Bureau of Mines, Washington, D.C.

[2] Where necessary, values have been converted from Hungarian Forints (FTs) to U.S. dollars at the rate of FTs 30=US$1.00.

Table 1.—Hungary: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1967	1968	1969 p
METALS				
Aluminum:				
Bauxite	thousand tons	1,650	1,959	1,935
Alumina	do	328	381	415
Metal:				
Ingots		61,796	63,088	64,463
Semimanufactures, unalloyed		r 55,289	NA	NA
Semimanufactures, alloyed		r 16,459	NA	NA
Copper, refined		1,308	1,140	1,092
Iron and steel:				
Iron ore	thousand tons	715	688	456
Pig iron:				
For steel	do	1,645	1,625	r 1,764
For foundry	do	10	13	NA
Ferroalloys	do	14	NA	14
Steel ingots	do	2,739	2,903	3,036
Rolled products	do	r 1,763	1,983	2,200
Manganese ore	do	209	e 209	156
NONMETALS				
Bentonite, crude	thousand tons	84	84	92
Cement	do	2,656	2,801	2,564
Dolomite	do	651	NA	NA

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Table 1.—Hungary: Production of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969 p
NONMETALS—Continued			
Fertilizers:			
Nitrogenous:			
Gross weight (with 20.5 percent N_2)—thousand tons	r 901	1,196	1,460
N_2 content—do	168	245	300
Phosphatic:			
Gross weight—do	r 827	846	916
P_2O_5 content—do	153	157	170
Kaolin, crude and washed—do	66	66	60
Lime, calcined—do	800	733	691
Quartzite—do	39	89	110
Sulfur, elemental	3,500	e 3,500	e 3,500
Sulfuric acid—thousand tons	424	446	455
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Bituminous—thousand tons	4,053	4,242	4,128
Brown—do	19,591	19,881	e 22,368
Lignite—do	3,385	3,090	
Coke and products:			
Coal coke—do	1,198	1,203	1,216
Of which coke oven coke—do	649	500	NA
Brown coal semicoke [4]—do	54	17	NA
Black pitch (from hard and brown coal)—do	16	11	NA
Fuel briquets—do	1,068	1,238	1,310
Gas:			
Natural—million cubic feet	72,218	95,031	119,178
Manufactured—do	20,165	20,235	20,680
Petroleum:			
Crude (specific gravity 0.91 in 1969)—thousand tons	1,686	1,807	1,754
Natural gasoline—do	63	62	60
Refinery products:			
Gasoline—do	607	729	616
Kerosine—do	2	4	1
Diesel fuel—do	1,261	1,391	1,525
Fuel oil—do	1,801	1,969	2,076
Lubricants:			
Oils—do	78	84	162
Greases—do	r 68	62	
Paraffin, crude	7,386	9,671	NA
Bitumen, natural and refinery—thousand tons	580	569	NA

e Estimate. p Preliminary. r Revised. NA Not available.

[1] In addition to listed commodities, Hungary produces arsenic, copper, gallium, gold, silver, lead, uranium, zinc, diatomite, and peat.

[2] Including ferroalloys.

[3] Including lignite.

[4] From the official trade returns of the United Nations.

Sources: Statisztikai Évkönyv 1968 (Statistical Yearbook 1968), Központi Statisztikai Hivatal, Budapest, 1970, pp. 394, for the years 1967 through 1968. Figures for 1969 were taken from U.S. Foreign Service despatches from the U.S. Legation in Budapest and from the files of the U.S. Bureau of Mines.

TRADE

During 1968 the pattern of Hungary's foreign trade in mineral commodities did not change substantially. The country imported most of its mineral requirements, such as nonferrous base metals, iron ore, high-rank coal, coke, and crude petroleum. Bauxite, alumina, manganese ore, and various semimanufactured products were exported. Principal trading partners were the U.S.S.R., and other Communist countries, which provided most of the fuel, iron ore, and metals. Definitive data regarding original destination were not available.

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Table 2.—Hungary: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum:			
Bauxite	thousand tons	668	665
Alumina	do	245	361
Ingots		19,626	47,529
Scrap [1]		4,879	4,698
Copper scrap		2,136	2,358
Iron and steel:			
Pig iron		79,496	68,488
Rolled products, excluding pipes	thousand tons	501	396
Pipes and fittings	do	r 46	37
Lead ores and concentrates [1]		2,903	3,048
Manganese ores [1]		3,690	5,852
Zinc ores and concentrates [1]		NA	NA
NONMETALS			
Cement	thousand tons	247	218
Clays, all kinds (bentonite)		r 668	665
Infusorial earth [1]		NA	NA
MINERAL FUELS AND RELATED MATERIALS			
Coke	thousand tons	r 142	180
Petroleum refinery products:			
Gasoline	do	218	244
Diesel fuel	do	217	240
Heating oil	do	r 470	560
Lubricants		r 10,694	23,714
Bitumen	thousand tons	r 187	150

r Revised. NA Not available.
[1] Statistical Office of the United Nations, New York, 1968.
Source: Official trade returns of Hungary, unless otherwise noted.

Table 3.—Hungary: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum ingots [1]		r 20,633	65,265
Cadmium [1]		r 30	NA
Chromite		r 11,000	r 11,000
Copper and copper products		r 8,952	r 13,000
Iron and steel:			
Iron ore	thousand tons	2,808	2,830
Pig iron	do	163	196
Ferroalloys	do	r 28	40
Semimanufactures, excluding pipes	do	149	134
Lead, refined		r 11,499	12,977
Tin	long tons	r 1,195	1,283
Zinc		r 16,186	18,228
NONMETALS			
Asbestos		14,114	r 13,800
Cryolite		r 1,000	r 900
Clay, calcined		64,965	68,149
Copper sulfate		11,776	4,846
Fertilizers:			
Nitrogenous	thousand tons	r 211	503
Potassic	do	r 337	387
Phosphatic	do	r 135	146
Fire clay		64,925	NA
Graphite		r 1,500	r 1,300
Magnesite, calcined		r 71,777	78,833
Pyrites, bulk	thousand tons	176	148
Phosphate rock	do	494	NA
Salt, all kinds	do	275	291
Sulfur, elemental	do	168	246
Sulfuric acid	do	87	45
MINERAL FUELS AND RELATED MATERIALS			
Briquets	thousand tons	521	491
Coal, all kinds	do	1,742	1,661
Coke, blast furnace	do	1,156	1,166
Gas, natural	million cubic feet	7,063	7,063
Petroleum:			
Crude	thousand tons	r 2,956	3,220
Refined products:			
Gasoline	do	71	78
Diesel fuel	do	130	147
Heating oils	do	346	333
Lubricants	do	23	10

r Revised. NA Not available.
[1] Source: Statistical office of the United Nations, New York, 1968.
[2] Partial figures from the official trade returns of the U.S.S.R.
Source: Official trade returns of Hungary, unless otherwise specified.

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COMMODITY REVIEW

METALS

Bauxite and Aluminum.—In 1969 Hungary maintained its position as a major European bauxite producer, with about 4 percent of world production. It is expected that production will increase by more than 50 percent by 1985 to about 3 to 3.5 million tons per year.

The Hungarian Government announced recently the allocation of funds for construction of two new bauxite mines. An expenditure of $14 million is planned at Rákhegy, Fejér County, to develop a mine with an output capacity of 350,000 tons annually by 1971. A second mine project, involving a $9.1 million investment and a production capacity of 400,000 tons annually, was begun at an undisclosed site.

Hungary has four alumina plants, Ajka Inota, Almásfüzitö, and Mosonmagyaróvár, the largest being Ajka, with a 130,000-ton annual output. A new 120,000 ton-per-year plant is scheduled to be commissioned, also at Ajka, in 1971.

Hungary's two aluminum smelters are located at Tatabánya and Ajka. Electricity for both smelters was supplied by local thermal powerplants. As Hungary is short of power, only about one-third of the domestic output of alumina is converted to metal. As a more economical alternative, alumina is exported on a toll smelting basis to Volgograd in the U.S.S.R. and reimported as metal for fabricating purposes. About 75,000 tons per year of alumina also is to be exported to the Austrian smelter of Vereinigte Metallwerke Ranshofen-Berndorff A.G.

Hungary's National Bank has concluded a $15 million credit agreement with Bolsa, a consortium of unidentified Western banking establishments. Funds are to be used to provide Hungary's developing aluminum industry with modern machinery from the West.

According to 1970 plans for the alumium industry, production values should increase an average 15 percent during the year with the greatest increase (40 percent) to be expected in the area of semifinished products.

Iron and Steel.—As in the past, Hungary imported about four-fifths of the iron ore used by the steel industry in 1969; the remainder was of domestic origin.

Plans were said to have been made for Hungary to participate in investments designed to develop the ferrous metallurgical sector of the Soviet Union. Hungary's steel requirements are reportedly increasing by 130,000 to 150,000 tons per annum, and total demand is expected to reach 6 to 7 million tons, double the present figure, by 1985–90. The increased demand will be satisfied by purchases of Soviet steel products.

A new rolling mill for alloy steel sheet was reported to be under construction at the Lenin Foundry works in Diósgyör. The Ernst Thaelmann works of Magdeburg in East Germany will supply and install machinery for the new rolling mill, worth about $20 million.

NONMETALS

In 1969, Hungary was essentially self-sufficient in cement, lime, clays, and bentonite, though some cement was imported from Rumania to alleviate a temporary shortage. A number of nonmetallic minerals, such as asbestos, cryolite, phosphate rock, salt, sulfur, and pyrites, had to be imported, to meet domestic needs.

Chlorine.—Test runs were performed on the new alkali-chloride electrolysis plant, the equipment of which was imported from East Germany, at the Borsod Chemical Combine (BVK). Design capacity was reportedly 15,000 tons of liquid chlorine and 17,500 tons of caustic soda per year for the domestic aluminum industry.

Fertilizers.—During the last 8 years, Hungary's output of nitrogen fertilizer has increased almost fivefold in value. The first nitrogen fertilizer plant was built in Várpalota, based on the gasification of lignite, the product being calcium-ammonium nitrate with 15.5 percent nitrogen, soon raised to 20.5 percent. When the BVK was built in the late 1950's near Kazincbaczika, it was based on domestic natural gas. While small gas imports were received from Rumania, the Hungarian nitrogen industry in 1969 was based almost wholly on domestic resources of natural gas, and a significant network of oil and gas piplines has been built. Soviet gas is to be delivered by the mid-1970's through Czechoslovakia. The BVK ammonia plant was being replaced by

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a new 450-ton-per-day unit. The complex also includes plants for production of urea and caprolactam.

The last of three nitrogen complexes of Hungary, the Tiszapalkonya Complex (TVK) at Tiszapalkonya on the river Tisza not far from Miskolc, has an ammonia capacity of 560 tons daily (N_2). There were also plants producing nitric acid, ammonium/calcium nitrate, and urea.

As of 1969 it appeared that Hungary will be self-sufficient in nitrogen products by the mid-1970's.

It was reported that the Veszprém Heavy Chemical Industry Research Institute has devised production technology for a new nitrogen fertilizer called Calurea, consisting of calcium nitrate bonded with urea, of 46 percent nitrogen content.

Graphite.—Significant graphite deposits were reportedly found near the locality of Edelény, north of Miskolc.

Kaolin.—It was reported, that Kaolin deposits found in the Füzérradvány area, Borsod County, will be sufficient to supply Hungary for the next 25 years. Deposits exploited during 1969 were becoming depleted.

Magnesite.—According to plans the Magnesite Industry Works will build, near the village of Tiszavárkony, a 50,000 ton-per-year plant for manufacturing synthetic magnesite, to be commissioned in 1972. Carbon dioxide for the process, sufficient to supply the plant for more than 75 years, was said to be available from nearby springs.

Sulfur.—The Komáromi Köolajfeldogozó Vállalat (Komárom Oil Refining Co.) has installed a sulfur recovery unit at its Szöny refinery, near Komárom. The plant was built with equipment from the U.S.S.R, design capacity being 4,800 tons of sulfur per year.

MINERAL FUELS

During 1969 low-rank coal remained the principal source of energy in Hungary. The combined share of the energy market supplied by natural gas and petroleum increased to about 41.7 percent, and is to increase to 56.6 percent by the end of the fourth 5-year plan in 1975. Fuel imports from the U.S.S.R. in 1969 increased.

Coal.—Output of coal and lignite decreased in accordance with plans for concentration and improvement in the productivity of the mining industry. In 1965 there were 124 collieries with a daily production of 770 tons each. It was planned to reduce the number of collieries to 83 by 1970, with an average daily output of 1,020 tons, and to 70 collieries in 1975 with 1,200 tons each.

The proportion of coal produced mechanically rose from 20 percent in 1968 to 33 percent in 1969. Ninety percent of the coal produced was transported by conveyors, as compared with 83 percent in 1968. In November, continuous production started at the Thorez opencast lignite mine at Visonta. An excavator of 460 tons per hour capacity was feeding a conveyor system to the powerplant.

The Zobák mine in the Mecsek coalfield went on stream in October, with a production of 3,000 tons per day. The depth of the mine was 2,100 feet.

Nuclear Power.—It was reported that the fourth 5-year plan (1971–75) contemplates construction of a 860-megawatt nuclear powerplant on the Danube River near Paks, in cooperation with the U.S.S.R.

Petroleum and Natural Gas.—*Drilling and Production.*—In the Szeged hydrocarbon basin 260 oil and gas wells have been drilled out of a planned 600. Twenty-one layers containing hydrocarbons have been discovered at depths between 3,400 and 6,450 feet. Ten of the layers contain petroleum, while 11 contain natural gas. Plans call for annual extraction of 1 million tons of oil and 70 billion cubic feet of natural gas.

The National Oil and Gas Industry Trust will spend $50 million for prospecting. Drilling will be extended to the area of Kisalföld, Békés County, the West Transdanubian area, and the Jászágo area, and prospecting continued in the Szeged–Algyö areas. It has been estimated that only one-third of the economic deposits have been tapped for production.

Refining.—Hungary's refining capacity in 1969 was about 6.5 million tons per year. This capacity was distributed among five refineries, as follows:

Refinery	*Annual capacity (million tons)*
Százhalombatta	3.5
Szöny	2.0
Zalaegerszeg, Pét, Nyirbogdány	1.5

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According to present plans Százhalombatta is to be expanded by 3 million tons by 1975, and a new refinery of 5 million tons was planned at an unspecified location in north Hungary.

Trade and Distribution.—Increasing amounts of crude oil were imported by the Barátság (Friendship) pipeline from the U.S.S.R. The Friendship II pipeline, parallel to Friendship I, is to be laid before 1975. Its diameter will be 560 millimeters as compared with the 400-millimeter diameters of the Friendship I. Upon completion imports from the U.S.S.R. are to increase to 6.5 million tons per year.

In addition to imports from Soviet and Egyptian sources import requirements in the early 1970's are expected to increase by 0.5 to 1.0 million tons per year. A substantial part of this will be purchased from the National Iranian Oil Company.

Natural gas reserves were estimated at about 4,000 billion cubic feet in 1969. Expected annual production by 1975 is 158 billion cubic feet. It is planned to import about 35 billion cubic feet per year via an extension of the U.S.S.R. pipeline from Czechoslovakia.

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The Mineral Industry of India

By Charles L. Kimbell [1] and Charles W. Sweetwood [2]

India's mineral industry in 1969 again registered gains in most traditional measures of its growth and development. The value of crude mineral output stood at a new high of nearly $543 million,[3] value of mineral commodity and mineral product exports reached $386 million, and the value of mineral commodity imports declined to $634 million, reflecting increased self-sufficiency in many commodities.

Mining alone reportedly contributed of the order of 1.1 percent to India's gross national product (GNP), which for year ending March 31, 1970, was estimated at $43.18 billion. In addition to the contribution of mining and quarrying operations, mineral processing (included statistically in Indian sources as an inseparable part of "large scale manufacturing") presumably made a contribution several times that of mining and quarrying. Thus the nation's total mineral industry contribution to the GNP presumably was of the order of 4 to 6 percent.

In the case of mineral commodity trade, India improved its trade balance position again in 1969, as imports of these materials declined and exports advanced slightly, but nevertheless, the nation remained a net importer of mineral commodities, with a deficit of the order of almost $248 million, chiefly due to petroleum and manufactured fertilizer imports.

As in past years, despite a substantial growth in production levels, a number of elements of India's mineral industry operated below rated capacity, and efforts to increase capacities to meet anticipated production goals were continued. This situation is most noticeable in the coal and steel industries but also affects other mineral industry sectors.

Recently released data of the Indian Ministry of Labor, Employment and Rehabilitation covering the year 1968 indicate that the nation's mineral and mineral-based industries employed a total of nearly 1.4 million persons, roughly 7 percent of India's labor force, as follows:

Industry sector	Persons employed (thousands)
Mining and quarrying:	
Coal	395
Limestone and dolomite	59
Iron ore	52
Manganese	37
Mica	17
Gold	12
Stone	10
Petroleum	9
Other	53
Subtotal	644
Nonmetallic mineral products	245
Iron and steel	229
Nonferrous metals	56
Metal products	205
Total	1,379

Of the total mining and quarrying labor force about half are union members, and of the workers engaged in the processing sectors, most are, at least in name, union affiliated. Labor unrest continued through 1969 and in some industry sectors intensified. In coal mining, there were 153 strikes and 5 lockouts in 1969 (174 strikes and 2 lockouts in 1968), with a time loss of 625,000 man days (350,000 in 1968). In mines other than coal mines (also excluding oilfield operations), there were 100 strikes and six lockouts with a total loss of 852,000 man-days (400,000 man-days lost in 1968).

Active mineral operations (including oilfields but excluding disassociated gasfields)

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[3] Where necessary, values have been converted from Indian Rupees (Rs) to U.S. dollars at the rate of RS1=US$0.133.

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numbered between 2,800 and 3,100 during 1969. Official Indian sources list 2,801 mines as of January 1, 1970, but apparently did not include some mica mines and iron mines that produced during 1969. Most numerous were coal mines, of which 792 were listed, followed by mica mines (477 officially listed, unofficial estimates total 650), and iron mines (160 officially listed, other suorces indicate 235 in operation during the year). These three commodities, together with five others account for about 90 percent of all actively exploited deposits. The other five commodities, together with the officially listed number of mines producing were Limestone—247; manganese ore—219; china clay—103; steatite—98; and gypsum—95.

Mineral exploration activity continued at a rapid pace in 1969. The Geological Survey of India (GSI) accelerated its field efforts, particularly in nonferrous metals, groundwater investigations, geophysical studies, and mapping. Also, the GSI, in cooperation with the Indian Bureau of Mines, continued with a program of reevaluation of India's proved and indicated ore reserves in light of current operating costs and market values. (Results of this effort for some commodities have been included in the Commodity Review section of this chapter.)

The U.S. Agency for International Development (AID) sponsored nonferrous metals-oriented mineral survey, "Operation Hardrock", moved into its third and final phase during 1969. Phase I (aerial geophysical surveys of selected areas) was completed in 1968; Phase II (geological, geophysical and geochemical ground followup) began in 1968 and continued into 1969, and Phase III (core drilling in indicated anomalies) was well underway at yearend, with detection of additional vein-type copper mineralization in the vicinity of the already discovered Khetri deposit in Rajasthan. The AID-sponsored "Operation Softrock" in Uttar Pradesh, aimed at discovery of commercial phosphate mineralization was almost completed by yearend 1969, with only some metallurgical studies incomplete at that time. Unfortunately, results were disappointing from an economic viewpoint, owing to the probable high cost of operations brought on by (1) inaccessibility; (2) difficult mining conditions; (3) limited reserves; and (4) necessity of beneficiating virtually all ores produced.

In addition a United Nations-aided nonferrous metals airborne geophysical study (similar in concept to "Operation Hardrock") continued thoroughout 1969 and recorded some success in the Mamandur area of Tamil Nadu. Here, reserves of 2 million tons of ore containing 5 percent combined lead, zinc, and copper have already been proved, and other nearby occurrences detected by the program are expected to prove to contain sufficient material to justify a full-scale mining and processing operation.

In the field of oil exploration, efforts continued onshore with no remarkable finds in 1969 in either the Cambay or Assam areas, while preparations were underway for an early 1970 start on shallow offshore exploratory drilling. Deep water offshore drilling to test the so-called "Bombay High" anomaly remained a subject of debate, with no decision at yearend as to whether India would attempt such a project wholly on its own or with assistance from foreign firms with experience in this difficult type of work.

Heavy Government involvement in mineral commodity trade continued in 1969, with the Minerals and Metals Trading Corporation monopolizing exports of iron ore (except that from Goa), manganese ore, and coal, and being active in export of other commodities; while the State Trading Corporation exported cement and salt among other commodities, and regulated imports of sulfur, phosphate rock, and mercury as well as of other commodities. In addition, the state owned Indian Oil Corporation was the sole purchaser of imported petroleum refinery products (except lubricants).

The revised fourth 5-year plan (April 1, 1969, to March 31, 1974) calls for the investment during the plan period of $3.88 billion for industrial and minerals-metals-fuels oriented projects, including $1.32 billion for metals industry development and $0.95 billion for minerals including petroleum. This planned investment may be compared with a total Central Government investment in public sector mining and manufacturing projects of $5.23 billion as of March 31, 1969, which included $1.74 billion invested in the steel industry, $0.56 billion invested in petroleum, and $0.43 billion in other minerals and metals projects.

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Under the revised fourth 5-year plan expansion of the public sector role in operations is slated to continue. While expansion of existing private sector operations and opening of new private sector ventures in the minerals field are not prohibited, it is clear that in keeping with its Industrial Policy Resolution of April 1956, the Central Government is continuing to pursue a policy of intensive public sector development. Private sector growth will be limited to those projects deemed in the national interest but which the Central Government is unable to undertake for financial or technical reasons.

PRODUCTION

While the percent increase in India's crude mineral output value between 1968 and 1969 was attributed in some degree to expanded output for most major and many minor commodities, the sharp 21.2 percent value rise for bituminous coal overshadowed other gains on a dollar basis. The preeminence of that commodity, which alone accounted for about three-fifths of total crude mineral output value in 1969, is shown in the following tabulation, which gives crude mineral output value by major commodity groups:

Commodity group	Million dollars		
	1967	1968	1969
Metallic minerals:			
Ferrous	45.27	50.13	54.33
Nonferrous	12.05	15.02	15.91
Subtotal	57.32	65.15	70.24
Nonmetallic minerals	39.89	47.76	55.32
Mineral fuels:			
Bituminous coal	265.21	269.52	326.65
Lignite	10.16	10.45	11.35
Petroleum, crude [1]	61.18	63.15	75.00
Gas, natural [2]	2.79	3.63	4.38
Subtotal	339.34	346.75	417.38
Total	r436.55	r459.66	542.94

r Revised.
[1] Estimated, applying a value of $1.45 per barrel produced.
[2] Estimated, applying a value of $0.17 per thousand cubic feet produced.

The increase credited to bituminous coal was chiefly the result of the assignment of higher unit value to coal output; physical production advanced only about 3.3 percent over that of 1968.

Indian sources do not assign a value to petroleum production and the $1.45-per-barrel figure used in estimating this commodity's output value in the preceding tabulation is only arbitrary. Nevertheless the figures emphasize the importance of domestic coal relative to crude oil, despite the 18.8-percent increase in the value of crude oil output in 1969. Similarly, natural gas value figures have been estimated on an arbitrary basis, but at almost any reasonable price, natural gas remains by far the least important of India's mineral fuels.

The $4.2 million, 8.4-percent increase accorded to ferrous metals for 1969 was chiefly due to a $3.5 million increase registered for iron ore. An increase in the per ton valuation of manganese ore, coupled with a modest rise in output, made that commodity's contribution to the ferrous metal total increase about $700,000.

Among the nonferrous metal ores, increases in output of bauxite, copper ore, and silver more than compensated on a value basis for lower production levels credited to gold mining, lead-zinc mining, and ilmenite-rutile sand recovery.

Most crude nonmetallic mineral commodities showed gains both in terms of volume and value of output, but the bulk of the increase was credited to greater output of salt and limestone. Although of little significance in terms of total nonmetals

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output value, the advent of phosphate rock mining in India was a noteworthy event in 1969.

Among the metals and other mineral-derived products produced in India, the most significant gains in 1969 were in output of refined petroleum (as the nation's ninth refinery came on stream) and cement. The steel industry and the aluminum industry recorded modest gains, while copper and zinc smelter output advanced only marginally and smelter lead output fell.

Table 1.—India: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969 p
METALS			
Aluminum:			
Bauxite, gross weight	788,526	936,290	992,000
Metal, primary only	96,223	120,100	131,160
Antimony, metal (regulus)	921	821	880
Beryllium, beryl, gross weight	r 1,300	p 1,300	p 1,300
Cadmium, metal	-------	41	59
Chromium, chromite, gross weight	109,535	205,659	216,741
Copper:			
Mine output, metal content	8,600	9,272	10,060
Metal refined, primary only	8,904	9,286	8,761
Gold, smelter troy ounces	101,628	115,357	109,473
Iron and steel:			
Iron ore and concentrate thousand tons	26,157	27,433	28,304
Pig iron, excluding blast furnace ferroalloys do	6,911	7,151	7,337
Ferroalloys:			
Ferrochrome	-------	1,080	2,200
Ferromanganese	131,192	146,800	167,620
Ferrosilicon	20,000	20,500	27,228
Steel ingots (excluding castings) thousand tons	r 6,387	6,448	6,461
Steel semimanufactures:			
Angles, shapes, sections do	821	919	889
Bars and rods do	1,581	1,435	1,737
Plates and sheets:			
Uncoated do	665	664	601
Galvanized do	49	167	204
Tinplate do	78	91	88
Hoop, strip, skelp do	375	490	569
Rails and accessories do	489	530	494
Wire do	104	159	183
Special steels, form not specified do	-------	38	301
Lead:			
Mine output, metal content	2,366	2,550	2,031
Metal, primary only	2,474	1,500	1,983
Manganese, ore and concentrate thousand tons	1,589	1,602	1,605
Rare-earth metals, monazite concentrates, gross weight e	2,600	2,600	2,600
Silver, smelter output thousand troy ounces	112	90	127
Titanium:			
Ilmenite concentrate, gross weight	41,585	58,725	51,445
Rutile concentrate, gross weight	2,538	2,686	2,496
Tungsten, mine output, metal content	15	20	21
Zinc:			
Mine output, metal content	5,269	6,968	8,735
Metal	8,039	20,699	24,231
NONMETALS			
Abrasives, natural, n.e.s.:			
Corundum, natural	306	326	537
Garnet	283	1,983	1,767
Asbestos	7,014	9,065	9,738
Barite	51,707	51,718	51,795
Cement, hydraulic thousand tons	11,700	11,940	13,260
Chalk	22,811	48,915	45,601
Clays:			
Ball clay	7,782	8,353	5,125
Fire clay	397,663	418,706	432,661
Kaolin (china clay) [3]	513,000	505,961	563,286
Diamond:			
Gem carats	p 5,442	7,280	p 7,238
Industrial do	p 960	1,484	p 2,000
Total do	6,402	8,764	9,238
Feldspar	27,528	33,493	34,157
Fertilizer materials:			
Crude, phosphatic:			
Apatite	11,554	6,695	8,964

See footnotes at end of table.

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Table 1.—India: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]		1967	1968	1969 [p]
NONMETALS—Continued				
Fertilizer materials—Continued				
Crude, phosphatic—Continued				
Phosphate rock		-------	--------	69,175
Manufactured:				
Nitrogenous, nitrogen content [4]		328,812	434,088	e 520,000
Phosphatic, P_2O_5 content [5]		181,812	182,592	e 190,000
Fluorspar, all grades		1,613	1,184	2,164
Gem stones, excluding diamond:				
Agate (including chalcedony pebbles)		452	630	411
Emerald:				
Crude	thousand carats	38	28	9
Dressed	do.	-------	79	11
Garnet	kilograms	6,068	4,986	2,665
Sapphire	do.	189	145	NA
Gypsum	thousand tons	1,028	1,821	1,440
Kyanite and related materials:				
Kyanite		49,549	64,361	66,285
Sillimanite		5,795	4,651	3,798
Lime		359,133	283,984	304,938
Magnesite		245,750	253,073	260,208
Mica:				
Crude		17,017	17,667	17,626
Processed: [6]				
Blocks		1,607	1,731	1,789
Splittings		5,527	6,188	6,686
Condenser film		92	87	107
Other		13,947	14,186	12,474
Pigments, natural mineral, ocher		36,042	35,494	36,837
Quartz and silica	thousand tons	259	294	378
Salt, all types	do.	4,488	5,044	6,380
Stone, sand and gravel:				
Calcite		16,063	13,292	17,238
Dolomite	thousand tons	1,144	1,259	1,331
Limestone	do.	19,390	20,745	22,040
Slate		1,304	859	734
Sand, calcareous	thousand tons	872	822	891
Talc and related materials:				
Pyrophyllite		4,934	10,286	7,833
Steatite (soapstone)		130,195	165,326	178,796
Vermiculite		317	2,348	5,183
MINERAL FUELS AND RELATED MATERIALS				
Carbon black [e]		25,000	25,000	25,000
Coal:				
Bituminous	thousand tons	68,206	70,814	73,149
Lignite	do.	2,930	4,126	4,186
Coke:				
Coke oven and beehive	do.	7,590	7,368	e 7,400
Gashouse	do.	67	e 50	e 55
Other soft	do.	2,800	2,985	e 3,000
Total	do.	r 10,457	10,403	e 10,455
Gas, natural	million cubic feet [7]	16,439	21,847	25,758
Petroleum:				
Crude oil	thousand 42-gallon barrels	42,190	43,552	51,724
Refinery products:				
Gasoline and naphtha	do.	21,514	21,895	24,447
Kerosine and jet fuel	do.	19,336	24,573	25,979
Distillate fuel oil	do.	29,683	32,435	35,679
Residual fuel oil [8]	do.	24,409	26,314	27,407
Lubricants	do.	448	469	585
Other	do.	4,531	9,366	10,477
Refinery fuel including losses	do.	6,861	5,394	6,794
Total	do.	106,782	120,446	131,868

e Estimate. p Preliminary. r Revised. NA Not available.

[1] In addition to commodities listed, India also produces bromine, other clays (bentonite and fuller's earth), other varieties of gem stones (aquamarine, ruby, and spinel) uranium, and natural graphite, but production data are not available.

[2] Actual production not reported owing to Indian Government security regulations; data presented are exports to the United States as reported by India's Atomic Energy Department.

[3] Data given are total crude production; includes directly salable crude as follows, in tons: 1967—182,000; 1968—156,001; 1969—160,227. Balance of output in each year is classified as "nonsalable crude"; material which requires beneficiation prior to sale. Processing of nonsalable crude resulted in the production of the following quantities of processed china clay in tons: 1967—98,000; 1968—102,123; 1969—99,087.

[4] Includes nitrogen content of nitrogen-phosphate fertilizers.

[5] Includes phosphorus content of nitrogen-phosphate fertilizers.

[6] Actual production data not available; figures given are exports but are believed to closely approximate actual output in most years.

[7] Converted from cubic meters at the rate of 1 cubic meter equals 35.3145 cubic feet.

[8] Includes material identified in source as low sulfur heavy stock.

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TRADE

Detailed statistics on the value of India's total mineral commodity trade in 1969 were not available in time for inclusion in this report, but partial data available indicate that the value of all mineral commodity exports approximated $386 million, while the value of all mineral commodity imports totaled about $634 million. Using these approximate figures, mineral commodities accounted for about 21 percent of total commodity exports and almost 30 percent of total commodity imports, which totaled $1,823 million and $2,119 million, respectively.

Among mineral commodity exports, iron ore, with a value of $127 million, was dominant, accounting for nearly one-third of the mineral commodity total, as in 1968. Among the imports, petroleum (crude and refined), iron and steel, and copper headed the list of major commodities, accounting for 29.3 percent, 27.6 percent, and 19.1 percent respectively, of the mineral commodity total.

Definitive data on India's principal trading partners in total mineral commodity trade were not available, but Japan clearly was dominant among destinations, probably accounting for 40 percent or more of total mineral commodity exports, while major sources of Indian mineral imports remained Iran (for crude oil only), the United States, Japan, West Germany, and the Soviet Union (not necessarily in that order).

Table 2.—India: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1968	1969
METALS			
Aluminum:			
Bauxite		98,916	73,883
Metal, including alloys, all forms		[1] 17,055	[1] 19,839
Chromite		108,822	115,426
Copper, metal including alloys, all forms		[1] 1,871	[1] 2,402
Iron and steel:			
Iron ore and concentrate	thousand tons	15,646	16,670
Pig iron and sponge iron	do	739	521
Ferroalloys:			
Ferromanganese		73,320	92,009
Ferrosilicon		3,161	6,816
Other		2,700	11,158
Iron and steel scrap	thousand tons	508	522
Steel ingots and semimanufactures	do	801	732
Lead, including alloys, all forms		[1] 3	[1] 12
Manganese ore and concentrate	thousand tons	1,195	1,184
Silver metal, all forms	thousand troy ounces	1,748	2,529
Tin, including alloys, all forms	long tons	[1] 149	[1] 197
Titanium, ore and concentrate (ilmenite)		48,525	50,946
Vanadium, ore and concentrate		------	4,750
Zinc, including alloys, all forms		[1] 21	[1] 21
Other, nonferrous metal scrap, not further identified		4,412	NA
NONMETALS			
Abrasives, natural, tripoli earth and emery		387	57
Asbestos		22	14
Barite		2,864	13,759
Bentonite		973	1,720
Cement		172,827	156,889
Chalk		28	7
Clays:			
Fire clay		102	49
Fuller's earth		8	90
Kaolin		86	157
Other		135	44
Diatomaceous earth (kieselguhr)		89	------
Feldspar		8,530	9,104
Graphite		160	153
Gypsum		950	5
Kyanite and related materials:			
Kyanite		50,464	46,256
Sillimanite		2,513	2,322
Lime		457	381
Magnesite		21,920	23,703
Mica, all grades		21,187	21,056
Mineral pigments		621	446
Salt	thousand tons	298	290

See footnotes at end of table.

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Table 2.—India: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1968	1969
NONMETALS—Continued			
Stone, sand and gravel:			
Building stone, not further identified		4,750	6,876
Gravel		2	-------
Limestone		408	-------
Marble		70	124
Sand, including natural quartz		3,052	2,796
Talc and related materials, steatite		9,734	25,405
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen		48	21,187
Coal and coke	thousand tons	498	320
Petroleum refinery products:			
Gasoline and naphtha	thousand 42-gallon barrels	4,601	5,691
Distillate fuel oil	do.	179	511
Residual fuel oil	do.	159	54
Petroleum coke	do.	75	-------
Asphalt	do.	27	142
Total	do.	5,041	6,398

NA Not available.

[1] Excludes scrap, if any, which is given subsequently as part of an aggregate of nonferrous metal scrap.

Table 3.—India: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1968	1969
METALS			
Aluminum, metal, all forms		13,298	1,970
Antimony:			
Ore and concentrate		1,731	1,478
Metal, all forms		2	-------
Arsenic sulfides		9	12
Copper, metal and alloys, all forms		35,914	43,555
Iron and steel:			
Pig iron, sponge iron and powder		273	455
Ferroalloys:			
Ferrochromium		707	361
Ferromanganese		128	86
Ferromolybdenum		426	57
Ferrophosphorus		377	187
Ferrosilicon		68	29
Ferrotungsten		34	12
Other		483	68
Total		2,223	800
Steel ingots and semimanufactures		418,827	370,320
Lead:			
Ore and concentrate		7	21
Metal, including alloys, all forms		35,219	31,402
Manganese ore		7,263	7,922
Nickel:			
Ore and concentrate		14	19
Metal and alloys, all forms		1,811	2,041
Platinum, metal	troy ounces	2,283	4,244
Silver, metal	do.	1,897	15,850
Tin, metal and alloys, all forms	long tons	4,095	2,609
Titanium ore		29	-------
Tungsten ore concentrate		207	136
Zinc:			
Ore and concentrate		19,408	29,998
Metal, including alloys, all forms		104,990	27,856
NONMETALS			
Abrasives, natural		68	578
Asbestos		26,670	31,609
Boron materials (borax)		4,067	1,700
Chalk		217	59
Clays:			
Ball clay		2,857	1,903
Bentonite		11	10
Fire clay		6	23
Fuller's earth		24	133

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Table 3.—India: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1968	1969
NONMETALS—Continued			
Clays—Continued			
Kaolin		2,105	3,045
Other		167	575
Diamond:			
Gem	value, thousands	$21,694	$33,376
Industrial	thousand carats	150	210
Diatomaceous earth		1,118	1,581
Fertilizer materials, crude:			
Nitrogenous, sodium nitrate		2,343	749
Phosphate rock	thousand tons	861	955
Potassium salts		7	-------
Fluorspar and cryolite:			
Cryolite		392	1,000
Fluorspar		4,293	9,715
Graphite		972	953
Gypsum and plaster		2	1
Magnesite		23	93
Mineral pigments:			
Red oxide		-------	1,653
Other		78	15
Stone, sand and gravel:			
Alabaster		43	39
Building stone, not further specified		2	12
Gravel		120	7
Limestone		-------	100
Marble		3	26
Sand, all types		485	168
Sulfur		389,447	427,388
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural		469	515
Coal, anthracite		241	1,085
Coke		601	8,588
Petroleum:			
Crude oil	thousand 42-gallon barrels	77,933	78,767
Refinery products:			
Aviation gasoline	do	r 351	359
Kerosine and jet fuel	do	r 3,519	4,658
Residual fuel oil	do	r 367	816
Lubricants	do	r 2,804	2,590
Total	do	r 7,041	8,423

r Revised.

COMMODITY REVIEW

METALS

Aluminum.—India, with a 1969 bauxite output of 992,000 tons, recorded a 6-percent increase in output over that of 1968, but slipped to 13th place among world producers. as Malaysia recorded a substantial gain in output to exceed India's production level. Aluminum metal production, totaling 131,160 tons, or 9 percent above that of 1968, was less than 2 percent of total world output but was more than adequate to meet general requirements, and imports fell to less than 2,000 tons.

Bauxite.—Growth of domestic markets for bauxite more than compensated for the 25-percent decline in exports in 1969, raising bauxite output to a new record high. Of total output, about 786,000 tons was used by the Indian aluminum producers, approximately 132,000 tons was consumed by chemical, refractory, abrasive, cement, and steel producers and nearly 74,000 tons was exported.

Bauxite reserves, optimistically placed at 276 million tons of proved and indicated ore (all grades), were revised sharply downward in 1969 to 160 million tons of material grading not less than 45 percent Al_2O_3, all recoverable by open pit operations. Of this total, high-grade ore (plus 50 percent Al_2O_3) amounts to 67 million tons, of which 32 percent is in Madhya Pradesh and 25 percent in Bihar (both in the East Central bauxite area); and 20 percent in Maharashtra and 18 percent in Gujarat (both in the Western area); while the remaining 5 percent is in small deposits in Orissa (East Central area), Tamil Nadu, Mysore, and Kerala in the extreme south of India and in Jammu-Kashmir in the far north. Of the 93 million tons

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grading 45 to 50 percent Al_2O_3, 57 percent is in Maharashtra, 11 percent each in Tamil Nadu and Jammu-Kashmir, 7 percent each in Madhya Pradesh and Gujarat, and the remaining 7 percent is distributed between Bihar, Orissa, Mysore and Kerala. Although the reduction in the reserve estimate is sizable, it poses little threat to continued growth of India's aluminum industry, even at the Indian Government output forecast level of 500,000 tons per year by 1980, assuming that exploration efforts directed toward finding additional high-grade ores and technologic studies directel toward economic utilization of lower grade ores are conducted within the near future.

Aluminum Ingot.—With an aggregate output of 131,160 tons, India's six aluminum plants operated near capacity in 1969, as shown in the following tabulation, which details production and capacity of existing facilities and proposed plant capacities for 1973:

Company, plant, and location of plant	Thousand metric tons		
	1969		1973
	Output	Capacity	Proposed capacity
Aluminium Corp. of India Ltd.:			
Asansol, West Bengal	5	9	12
Bharat Aluminium Co. Ltd.:			
Koyna, Maharashtra	------	------	30
Korba, Madhya Pradesh	------	------	60
Hindustan Aluminium Corp. Ltd.:			
Renukoot, Uttar Pradesh	72	75	100
Indian Aluminium Co. Ltd.:			
Alwaye, Kerala	16	16	16
Belgaum, Mysore[1]	5	30	60
Hirakud, Orissa	20	20	20
Madras Aluminium Co. Ltd.:			
Mettur, Tamil Nadu	13	14	25
Total	131	164	323

[1] Facility completed in October 1969, therefore did not produce at capacity for full year.

Further expansion plans call for raising total capacity to 473,000 tons by 1978, by expanding the eight plants listed above, and also by building a ninth plant, the proposed 30,000-ton-per-year Kanpur (Utter Pradesh) plant of J.K. Industries.

All currently operating plants are in the private sector; of the planned facilities, the two Bharat Aluminum Co. Ltd. plants will be public sector while the J.K. Industries plant will be private. The public sector facilities are to be built with assistance from Hungary (the $86.6 million Konya smelter and the $44.8 million Korba alumina plant) and the U.S.S.R. (the $88.5 million Korba smelter).

Beryl.—India remained one of the world's leading producers of beryl in 1969, but owing to the fact that the Government classifies beryl as a mineral strategic to national defense, information on mine development, production, and trade is not available for public distribution. However, reserves are large—adequate to support an output of 2,000 tons per year for many years, and assuming reasonable world prices and no Governmental restraints on exports, the nation should be able to supply sufficient beryl to meet any anticipated demand level in the forseeable future. The principal constraint on rapid expansion of production would be the "cottage industry" methods employed.

Cadmium.—India's output of cadmium, a byproluct of zinc smelter operations, increased over that of 1968, as the operation of the nation's two smelters, commissioned in 1967, became more normal. Of the total output, Hindustan Zinc Ltd. accounted for 36 tons with a rated 75-ton capacity, while Cominco Binani Zinc Ltd. produced 23 tons with a rated 30-ton capacity.

Chromite.—Indian chromite production moved upward by 5.4 percent to a new high of nearly 217,000 tons in 1969, but the growth was far less spectacular than the 88 percent increase recorded for 1968. Known, economically recoverable ore reserves, all in Orissa and Mysore, total 6.55 million tons, including 3.06 million tons of metallurgical and chemical grades (48 to 56 percent Cr_2O_3) and 3.49 million tons of refractory grades (38 to 48 percent Cr_2O_3). Other deposits, as yet unevaluated, are known in Andhra Pradesh, Bihar, Maharashtra, and Tamil Nadu.

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Of the total output, 115,426 tons was exported, all to Japan, including 86,156 tons grading 48 to 56 percent Cr_2O_3, 13,864 tons grading 38 to 48 percent Cr_2O_3, and 15,406 tons grading under 38 percent Cr_2O_3. With a 1968 export of 108,822 tons, it appeared that India was developing a substantial inventory of unsold chromite, and domestic markets remained quite modest. Prior to 1969, local consumption for ferroalloy production was only sufficient to provide for the output of 1,500 to 2,000 tons of ferrochrome. During 1969, however, two new ferrochrome facilities were commissioned. In November, Orissa State Industrial Development Corporation (public sector) inaugurated its Swedish-built Jaipur Road plant, with a rated annual capacity of 10,000 tons of ferrochrome and 700 tons of silicochrome. In December, Ferro-Alloy Corp. Ltd. opened a plant at Shreerampur, Andhra Pradesh, with a rated annual capacity of 10,000 tons of low-carbon ferrochrome, 5,000 tons of high-carbon ferrochrome, and 4,000 tons of silicochrome.

Copper.—In spite of a significant reduction in the estimated demand for copper in India by the Government Planning Commission (1968 estimate—104,000 tons; 1969 estimate—85,000 tons), the nation in 1969 remained heavily dependent upon imports to meet requirements, as smelter production totaled only 8,761 tons, all from domestic ore processed by the private sector Indian Copper Corp.

While work continued on the Khetri-Kolihan copper mining and smelting project of the public sector Hindustan Copper Ltd., there was some question that the target date of 1973 would be met. Activities here in 1969 were limited chiefly to exploration drilling that led to an upward revision of total (proved, indicated, and inferred) reserves from 64.35 million tons to 101.35 million tons and to work on two vertical shafts. These shafts, with a planned depth of about 1,500 feet, had reportedly reached 1,270 feet (production shaft) and 950 feet (service shaft) at yearend. Some on-site work for the refinery was carried out, but equipment deliveries, both for imported and domestically fabricated equipment, fell behind schedule. The total estimated cost of the project was revised upward to $123.7 million.

As in 1968, substantive progress was not evident in other public sector copper development projects, most notably the Rakha mine project of Hindustan Copper Ltd., for which the Government has approved expenditure of $10 million.

New field work in 1969 coupled with reevaluation of some previously collected data revised the appraisal of India's more important copper reserves upward to over 3.5 million tons of contained copper in 11 deposits with ore grades of 0.6 to 2.5 percent. This total includes 943,000 tons copper contained in proved ore bodies, 1,556,000 tons in indicated ore bodies, and 1,001,000 tons in inferred ore bodies. Principal deposits are the Khetri-Kolihan (783,850 tons contained copper in ores containing 2.5 percent copper and 700,000 tons in ores containing 1 percent copper), the Rakha deposit (1,140,100 tons of copper in ores grading 1.3 percent copper), and the Mosabani deposit (670,000 tons of copper in ores grading 2 percent copper). The national total given above is incomplete, there being no reliable data available on a number of occurrences.

Gold.—In keeping with the anticipated production pattern, Indian gold output declined almost 5 percent in 1969 with respect to 1968 performance. The larger of the nation's two producers, the Central Government's Kolar Gold Mining Undertaking, registered a 6.1-percent decline in quantity of ore produced (to 377,853 tons) and a decline in ore grade from 0.22 troy ounce per ton in 1968 to 0.20 ounce per ton in 1969. The other producer, the Mysore State enterprise, Hutti Gold Mines Company recorded an increase in both ore output and ore grade (99,678 tons of ore grading 0.28 ounce per ton in 1968 to 109,495 tons grading 0.31 ounce per ton in 1969), but this increase was insufficient to maintain total national output at the 1968 level.

Ore reserves, however, were increased in 1969 from 3.8 million metric tons averaging 8.5 grams (0.27 troy ounce) of gold per ton to 4.6 million metric tons of the same grade. Reports indicate that preliminary steps have been taken to reactivate a section of the Kolar mine in its "Northern Fold" area, which was regarded as a good producer prior to its 1962 closure following a severe rock burst and fire on several of the lower levels. Similarly, old workings in the "Southern Fold" area are to be reopened to permit geologic study of previously bypassed ore bodies.

Ilmenite, Rutile, and Monazite.—With

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mineral sand deposits ranking among the world's largest, India remained in 1969 only a modest producer of the principal constitutent minerals, ilmenite and rutile, and presumably was only a modest producer of monazite. (Output of the latter is not reported, being classified as security information affecting India's national defense posture; however, it is estimated at about 2,600 tons per year.) No firm data on total national reserves are available, but estimates of 160 million tons of ilmenite (53 to 60 percent TiO_2) and 5 million tons of monazite (8 to 10 percent ThO_2) have been made for beach sands of the States of Kerala and Tamil Nadu alone. Moreover, including sandstone beds inland from the black mineral sand beaches, some authorities, including the GSI, have made estimates of 200 million to 356 million tons of ilmenite, with no estimates of monazite or rutile.

Indian output stood at more than 300,000 tons of ilmenite prior to 1960, chiefly for use by pigment producers, but output fell owing to the development of alternate sources which are not affected by chromium contamination as is the Indian ilmenite. This contamination, however, is of little importance when the ilmenite is used for production of titanium metal. Thus, should world titanium metal output be increased, the Indian mine product could serve as a satisfactory raw material.

Indian mineral sand production facilities are all in the hands of the Government-owned Indian Rare Earths Ltd. These facilities consist of two plants, one at Manavalakurichi in Tamil Nadu, commissioned in 1967 with a daily output of 300 tons, and the second at Chavara in Kerala. The latter plant was inoperative in 1969, while undergoing expansion and modernization aimed at upping annual output to 100,000 tons of ilmenite, 5,850 tons of rutile, 7,000 tons of zircon, 585 tons of monazite, and 4,100 tons of sillimanite.

Of total output, about 14,000 tons of ilmenite is consumed annually in India to produce 6,500 tons of titanium dioxide pigment. The consumers, Travancore Titanium Products Ltd. of Kochuveli, Kerala State, has plans to increase pigment output to 24,000 tons by 1971.

Iron Ore.—The 3.2-percent growth in Indian iron ore output predominatly was a reflection of continued growth in the export market, although there was an increase of about 350,000 tons in domestic use to a 1969 total of 11.63 million tons. Exports in 1969 advanced by about 1 million tons in quantity and $11 million in value, as the average per ton value increased for the second year from the low of $6.95 registered in 1967 to $7.66 in 1969. Exports are shown by destination in table 4.

Although the per ton price realized from sales of iron ore increased, rather than decreased as Indian forecasters expected, operating costs increased at an even more rapid pace and reportedly averaged $7.99 per ton, indicating a loss of $0.33 per ton mined and shipped. Of this $7.99 cost, mining costs were $2.45, transport from mine to port was $3.86, port handling charges were $1.29, and miscellaneous costs were $0.39, while in addition, ocean shipments to Japan, for example, added $4.90 per ton, raising the c.i.f., port of destination cost to $12.89.

Table 4.—India: Exports of iron ore
(Million metric tons)

Destination	1968	1969
Belgium	0.37	0.35
Czechoslovakia	.98	.76
Germany:		
East	.02	.03
West	.30	.14
Hungary	.16	.18
Japan	12.51	18.85
Poland	.22	.39
Rumania	.75	.68
Yugoslavia	.24	.18
Other	.10	.11
Total	15.65	16.67

Despite the increases registered for both exports and domestic consumption, industry growth fell considerably short of forecasts by the Indian Government's Planning Commission, which envisaged consumption of 15.4 million tons and exports totaling 21.4 million tons.

In 1969, a total of 235 iron ore mines were in operation, all open pit. About 30 of these individually produce in excess of 100,000 tons annually, including four fully mechanized with modern equipment and nine partially mechanized. Eleven of the total of 235 are captive mines, providing ore to only one steel plant (either public or private sector), while the remainder, excluding those numbering about 60 in the former Portuguese enclave of Goa, either sell their ore domestically or export it

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through the Government-owned Minerals and Metals Trading Corporation (MMTC). Mines in Goa may sell ore on the export market directly, without involvement of MMTC.

Development of the Bailadila mine of National Minerals Development Corporation (NMDC) continued during 1969, following Planning Commission recommendations. The property supposedly will become the country's largest single producer with a target output of 9.1 million tons annually by 1973. NMDC also carried out development drilling, pit layout, and road construction at its Donimalai mine in Mysore, but the 1971–72 production goal was revised downward to 1.7 million tons. Studies and preliminary work on the Kudremukh property were also pushed forward in 1969, but exploitation of the property still was not expected until 1974–75. This project, jointly owned by NMDC (51 percent) and private firms (Marcona Corp., San Francisco, Calif.,—25 percent and several Japanese firms—24 percent in total), is tentatively slated to produce 4 million tons per year of 60 percent iron concentrates from 40 to 60 percent iron ores which will be pelletized in Japan if present studies do not lead to revisions in the scheme.

Elsewhere, expansion of the major Kiriburu mine of NMDC from 2 million to 5 million tons apparently continued, while the Orissa State Government's 4-million-ton-per-year operation at Daitari was apparently completed in June of 1969. Ore from this deposit was originally slated to be exported to Japanese firms, but these firms rescinded an earlier decision to buy this ore on the basis that the alumina content was too high and MMTC was forced to arrange a new market. Rumania accepted the product for delivery under a 23.4-million-ton contract and output has commenced at Daitari.

Progress, if any, was unreported on development of a pelletizing plant in the Salem District of Tamil Nadu to process ores for a proposed State Government-owned steel plant.

National ireon ore reserves are more than adequate to support any foreseeable expansion of output; they are estimated at 21,583 million metric tons, including 7,594 million tons proved and indicated and 13,989 million tons inferred. The States of Bihar and Orissa together contain 43 percent of the proved and indicated reserve and 35 percent of the inferred reserve; Madhya Pradesh accounts for 28 percent of the proved and indicated reserve and 36 percent of the inferred reserve, and Mysore has 15 percent of the proved and indicated ore and 12 percent of the inferred ore, with the remaining 14 percent of proved and indicated ore and 17 percent of inferred ore located in other States.

Iron and Steel.—Although output failed to reach Planning Commission targets set for 1969, India's iron and steel industry did record gains in production to new highs in 1969, with pig iron, ferroalloy, and steel ingot output up by 2.6 percent, 17.0 percent, and 0.2 percent, respectively, above 1968 levels. India's trade balance in iron and steel remained favorable for a second year, with exports exceeding imports by almost $30.4 million and totaling $111.7 million, a slightly lower figure than the $112.5 million export value for 1968.

Internal iron and steel consumption again apparently totaled nearly 6.5 million metric tons in 1969, and demand was in excess of this figure, creating a severe shortage of rolled steel, particularly in the case of flat products. In an effort to alleviate the shortage, the nation's largest producer, the public sector Hindustan Steel Ltd., has revised its production program and under the revised plan is expanding the Bhilai plant from 2.5 million tons to 3.2 million tons. Construction of India's fourth major public sector steel plant, the Bokaro works, continued, but remained behind schedule, with completion not expected until 1972 or 1973.

Lead and Zinc.—India's entire 1969 domestic production of lead-zinc ore was again derived from only one mine, the Zawar property of Hindustan Zinc Ltd., about 25 miles south of Udaipur, Rajasthan. The nation remains dependent upon imports for a sizable share of its lead and zinc despite the fact that more than 100 lead-zinc occurrences are known, at least a few of which are regarded as economically operable.

In the Zawar mine area, total proved and indicated reserves were revised sharply upward in 1969 to 137.5 million metric tons of ore of an unspecified grade including 25 million tons in Zawar mine alone. Data previously released indicate that all ore included in this reserve grades 0.5 to 2.5 percent lead and 3.5 to 7.0 percent

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zinc. In 1969, ore output totaled 203,136 tons containing 1 percent lead and 4.3 percent zinc, from which 2,925 tons of lead concentrate and 13,407 tons of zinc concentrate were recovered, compared with 1968 results of 191,629 tons of ore, 3,566 tons of lead concentrates, and 12,839 tons of zinc concentrates.

Domestic output in 1969 was supplemented by imports, including 29,998 tons of zinc ore and concentrates (an increase of more than 10,000 tons above 1968 figures) and 21 tons of lead ore and concentrates.

India's single lead smelter, the 5,400-ton-per-year Tundoo smelter of Hindustan Zinc Ltd., produced at only 37 percent of capacity, providing only 1,983 tons of lead to the national supply. This modest output was augmented by imports of lead metal totaling 31,402 tons, including 591 tons of semimanufactures (the balance unwrought). Actual demand was estimated to be of the order of 57,000 to 65,000 tons of lead annually, and inasmuch as scrap availability totaled only about 7,500 tons, a supply-demand gap of 16,000 to 24,000 tons was indicated.

In the case of zinc metal, smelter output reached a new high, totaling 24,231 tons in 1969, but both of the nation's smelters continued to operate considerably below capacity. The Hindustan Zinc Ltd. Debari smelter near Udaipur produced only 8,715 tons of zinc (capacity 18,000 tons per year), while the Cominco Binani Zinc Ltd. Alwaye smelter in Kerala produced 15,516 tons of zinc with a 20,000-ton-per-year capacity.

Output of these plants was supplemented by imports of zinc metal and alloys totaling 27,856 tons (chiefly unwrought zinc), a quantity equal to only 27 percent of the 1968 import. The reduction in imports was made possible by the development of an unexpected surplus of zinc metal in India in 1968 and thus does not represent a radical decline in consumption but rather adjustments in stocks only.

In October, Hindustan Zinc Ltd. signed an agreement with a French firm to expand the capacity of the Debari smelter to 36,000 tons per year by 1974. The existing facility, however, as noted previously, operated under capacity and the reason assigned was an inadequate supply of zinc concentrates from the Zawar mine owing to the ill-equipped concentrator at the mine. Mine and concentrator expansion programs were under way in 1969, but completion was not scheduled until the end of 1971. Thus, to make capacity smelter operation possible, Hindustan Zinc called for global tenders for the purchase of 20,000 tons of zinc concentrates annually during 1970–72.

Hindustan Zinc also signed an agreement with a Czechoslovakian firm calling for a study regarding erection of a 30,000-ton-per-year smelter at Visakhapatnam, the plant to operate on imported concentrates. Cominco Binani reportedly requested Government permission to expand its Edayar plant at Alwaye to 60,000-ton-per-year capacity by 1974 in two 20,000-ton increments, and it was indicated that the Government has provisionally approved the expansion.

Manganese.—India's manganese industry recorded slightly higher production in 1969 than in 1968, enabling the nation to retain third rank among world producers. but exports declined slightly as a combination of production cost increases, continued Suez Canal closure, increasing Indian port costs, declining world market prices, and the emergence of new large-scale sources of supply continued to adversely affect Indian sales on world markets. Exports by type and destination are shown in table 5, domestic consumption in 1969 increased by about 70,000 to 740,000 tons, including 330,000 tons used in ferromanganese production, 400,000 tons used directly in steelmaking, and 10,000 tons used by battery producers.

During 1969, the Government Planning Commission announced that GSI, in a preliminary report, placed recoverable reserves, proved and probable, at 181.6 million tons of ore grading 30 percent manganese or higher, an amount very close to previously made general estimates, which included 7.68 million tons proved, 24.75 million tons indicated, and 147 million tons inferred.

Silver.—India's silver output is entirely byproduct recovery, with 94 percent of the total being recovered at lead and zinc smelters and the remaining 6 percent by gold producers. Planned increases in smelting of lead and zinc concentrates, the former all of domestic origin and the latter

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Table 5.—India: Exports of manganese ore by type and destination
(Thousand metric tons)

Type and destination	1968	1969
Types:		
Ore, 48 percent manganese or higher	161	[1] 154
Ore, 35 to 48 percent manganese	305	[1] 362
Ore, ferruginous, below 35 percent manganese	728	[1] 690
Peroxide and other processed oxides	1	[1] 2
Total, ores and similar materials	1,195	[1] 1,208
Destinations (all types):		
Belgium	60	67
Czechoslovakia	103	49
France	26	40
Germany, West	22	------
Japan	764	845
Netherlands	29	29
Norway	------	45
Rumania	------	19
Spain	17	19
United Kingdom	69	11
United States	87	60
Other	18	------
Total	1,195	1,184

[1] Data on exports by type for 1969 are from a compilation by the Indian Bureau of Mines and differ from that reported in official trade returns, which were used as source for all 1968 information in this table as well as for 1969 destinations.

of both domestic and imported materials, may substantially elevate output levels by 1974.

Uranium.—Although all activities relating to uranium exploration, production, and trade are conducted by the Government and despite security regulations preventing the publication of information on such subjects in the interest of national security, some facts on activities in this field have been released to the public. Most notably, it was reported that the Government-owned Uranium Corporation of India, Ltd., ore concentration plant at Jaduguda, Bihar, operated continuously during 1969 "nearly" at full rated input capacity of 1,000 tons of ore daily. This facility, the country's only such plant, is situated at the Jaduguda mine, where 12 kilometers of underground workings reportedly block out about 1 million tons of minable ore. The ore body, as now delineated, extends 1,000 meters along a structure and to a depth of at least 420 meters. This was the only property under exploitation in 1969, but occurrences at Umra and Udaisagar near Udaipur in Rajasthan have received some attention as possible additional sources, although it is reported that the ore grade in Rajasthan is only about one-fifth that of the Jaduguda deposit (the latter's grade is not reported).

NONMETALS

Cement.—Cement output advanced more than 1.3 million tons in 1969, and available information indicated that as in 1968, India remained in a position of self-sufficiency. The entire increase in output was absorbed by domestic users, as exports fell by nearly 16,000 to 156,889 tons, and year-end stocks declined by 34,000 to 240,000 tons. Production at about 90 percent of installed capacity, reportedly was held back by the Government's Cement Controller, to avoid the accumulation of surplus cement.

Of the total cement export, 80,987 tons was shipped to Nepal while 57,959 tons was destined for Ceylon.

Gypsum.—With a reserve of 1,173 million tons of gypsum (according to GSI estimates made in 1969), India is now and will remain self-sufficient in gypsum for many years. Output, at over 1.4 million tons, exceeded that of 1968 by over 9 percent. Of the 1969 output, 710,000 tons (grading 83 to 86 percent $CaSO_4 \cdot 2H_2O$) was consumed by one entity, the Government-owned Sindri Fertilizers and Chemicals, Ltd., which uses the mineral to produce ammonium sulfate. This firm was slated to terminate the use of gypsum as a raw material in 1969 upon completion of a pyrite-based sulfuric acid and triple superphosphate plant; however, opening of this facility was delayed, and furthermore, the source of pyrite for the new facility has been adjudged to require additional development before it will be ready to supply the required pyrite. The pyrite-based oper-

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ation was expected to produce an artificial gypsum which would be used by the Sindri ammonium sulfate plant, but the economic validity of such an operation has been questioned because such artificial gypsum has been found to contain deleterious impurities that adversely affect further processing to ammonium sulfate. It has been indicated that further study of the practicality of this scheme may have contributed to the delay in its implementation.

Kyanite and Sillimanite.—It has been reported that the Government of India is considering an early curtailment and possibly a total ban on kyanite exports within 5 years unless additional reserves are found. Domestic consumption apparently has increased considerably in recent years because of expanded production of high-temperature refractory bricks, gas burner tips, spark plugs, heater elements and high voltage electrical insulators—all of which use kyanite as a body-mix additive. In 1969, indigenous requirements for kyanite were estimated at 10,000 tons per year, and the Government forecast a demand of 18,000 tons per year by 1973. At the same time as domestic requirements increased, reserve estimates were revised downward to the vicinity of 500,000 to 600,000 tons which at present extraction rates constitutes only a 7-to-9-year reserve.

In the case of sillimanite, the resource situation is not as critical, with a reserve of at least 500,000 tons in three areas only and perhaps aggregating 2 million tons in total and an annual output of less than 10,000 tons. However, because of anticipated appreciable increases in local demand above the 1,500-ton level estimated for 1969, the Planning Commission has requested an economically oriented reappraisal of known reserves and an exploration program for new reserves during 1970.

Magnesite.—With output reaching a new high of 260,203 tons, India's magnesite industry registered a modest advance over its 1968 performance. The overwhelming bulk of output was consumed domestically, with refractory manufacturers consuming most of the total used in India. However, limited quantities were used in the manufacture of cement, rubber and boiler lagging, and inferior grade material was consumed in production of floor tile and mosaic flooring. Exports accounted for only 9 percent of the total produced in 1969.

Mica.—India retained its position as the world's leading supplier of strategic grades of mica in 1969. Recorded output of crude mica declined slightly, but it is believed that actual output increased, with a growing gap between recorded production and actual output. This gap is reflected in the difference between recorded crude mica output and recorded exports; the latter figure has consistently exceeded reported crude output, with no allowance for losses in processing. Recorded 1969 exports of strategic grades of mica were significantly greater than those for 1968 on a tonnage basis while exports of nonstrategic grades fell slightly; overall value of mica exports, however, advanced almost $700,000 and totaled over $22 million for 1969. Distribution of total exports by type appear in table 6; distribution of total exports by country on a tonnage basis are not available, but from the viewpoint of value, leading destinations of total mica exports were: U.S.S.R.—$5.0 million; United States—$3.5 million; Japan—$3.3 million; United Kingdom—$2.2 million; Poland—$1.2 million; and Czechoslovakia—$1.2 million.

Table 6.—India: Mica exports by type

(Metric tons)

Type	1968	1969
Block	1,731	1,790
Film	86	107
Cut condenser film and plate	37	36
Cut sheet and strip	21	27
Washer and disc	116	103
Splittings	6,001	6,686
Scrap and waste	10,939	8,997
Powder	2,244	3,289
Micanite and builtup mica	12	21
Total	21,187	21,056

Phosphate Rock.—Commercial scale phosphate rock mining began in July 1969 for the first time in India. Output through yearend totaled 69,175 tons, all from the Jhamar Kotra deposit of the Rajasthan Directorate of Mining and Geology, 13 miles southeast of Udaipur. While the actual 1969 production was small in comparison with the estimated requirement of about 1 million tons annually, it was indicated that a substantial increase would soon be in

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the offing. Late in 1969, the State of Rajasthan contracted with Bikaner Gypsum Co., Ltd., a joint public-private sector venture, to develop and mine the deposit for 10 years, with expansion to 1,000 tons per day to start in 1970, and with an ultimate goal of 2,000 to 5,000 tons per day.

Several other deposits are known in the same general area of Rajasthan, and at least one of these, the Matoon deposit, previously held by India's Central Government, was turned over to the public sector firm, Hindustan Zinc Ltd. in 1969 for development and mining. This deposit will require underground mining for all but a small part of the total ore present.

Reserves in the Udaipur area have been tentatively reported at 76 million tons, grading 20 to 36 percent, but it should be stressed that these figures are only partial and do not cover all known deposits. Because of the grade and general nature of the ore, beneficiation of much of this material is regarded as essential if the full potential of the deposits is to be realized. To this end, AID has provided a phosphate beneficiation specialist, at the request of the Indian Government, to advise on processing techniques, and plans call for pilot plant studies during 1970. Preliminary laboratory studies produced concentrates grading 36 percent P_2O_5 and 3 percent Fe_2O_3 with an 80 percent recovery from Matoon ores grading 20 percent P_2O_5 as mined.

Regarding the Mussoorie phosphate deposits of Uttar Pradesh discovered with AID assistance in 1968, exploration work was terminated in 1969, but beneficiation studies on these complex phosphates were continued under guidance of the AID beneficiation specialist. However, because of the remoteness of the deposits, the necessity for underground mining, the relatively low grade of ore and the question of the actual quantity of minable ore available, the potential of this region for development in the foreseeable future is questionable.

Salt.—India's salt output reached a new record high of almost 6.4 million tons in 1969. Of the total produced, about 70 percent was for direct consumption by humans and animals, 15 percent was used by the chemical industry, 4.5 percent was exported, and the remaining 10.5 percent was destined for miscellaneous domestic markets. Virtually all of the output was recovered by evaporation in coastal areas, one rock salt mine was in operation at Mandi in Himachal Pradesh (deposit reserves 700,000 tons), and a limited amount of salt was obtained from inland lake and subterranean brines in Rajasthan.

The State Trading Corporation, India's sole exporter of salt, embarked on a salt export sales promotion program in 1967, which produced quite satisfactory results insofar as contracts were concerned. However, despite a resource and facility base capable of supporting a sizable expansion of production for exports, the State Trading Corporation through 1969 was unable to meet its commitments because development of port-loading facilities fell behind plans, a situation which had not been improved through yearend.

MINERAL FUELS

Coal.—Coal continued to rank as India's leading mineral commodity in terms of value of crude output, accounting for slightly over 60 percent of the total for all commodities. The total value for coal, equivalent to $326.65 million, was 21 percent above that recorded for 1968, although physical output increased only 3.2 percent; this gives an average value per ton equivalent to $4.47, or 17 percent above that calculated for 1968.

Despite continual increases in coal output during 1964–69, the industry continued to operate much under capacity, which in 1964 was rated at 97 million tons and in 1969 at about 90 million tons.

Of total 1969 output, private collieries produced 74.4 percent, the National Coal Development Corporation (NCDC) collieries produced 20.5 percent, and Singareni Collieries Company (Andhra Pradesh State-Central Government owned) produced 5.1 percent. Corresponding 1968 percentages were 76.1, 18.0, and 5.9, respectively. Distributing total output by grade, 22.5 percent was coking coal and 77.5 percent was noncoking coal; distributing output by mining method, 22 percent was from opencast operations and 78 percent from underground mines.

A total of 792 mines were reported in production in 1969, 14 more than in 1968. The total was distributed as follows on the

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basis of quantity produced by each mine (1968 figures for comparison):

Output per year (metric tons)	1968	1969
More than 600,001	6	8
300,001–600,000	49	58
120,001–300,000	168	147
60,001–120,000	109	107
12,001–60,000	208	203
6,001–12,000	53	52
Below 6,001	185	217
Total	778	792

Coal consumption including exports in 1969 totaled about 72 million tons, distributed as follows by industrial sector, in million tons: Iron and steel industry—17; railways—16; thermal power stations—16; coke ovens—3; other, including exports—20. While the Government Planning Commission forecasts a demand (consumption plus exports) of 93.5 million tons in 1973 and such a level is possible if consumption continues to increase at the rate of about 7 million tons set in 1969, a level of 84 to 88 million tons for 1973 (annual increase of 3 to 4 million tons) appears more likely.

Proved coal reserves reportedly total about 45 billion tons, and a total national reserve of 120 billion tons (proved, indicated, and inferred) was reported in 1968.

Lignite.—The Neyveli Lignite Corporation (public sector) Neyveli mine remained the only significant producer in India through 1969, accounting for all but 61 tons of the nearly 4.2-million-ton national output. Facilities integrally associated with the lignite mine showed improved performance in 1969 but continued to operate well below rated capacities. The urea fertilizer plant produced 96,718 tons in 1969, or about 64 percent of capacity (51 percent in 1968) and the briqueting and carbonizing plant, which produces smokeless domestic fuel briquets, produced 149,197 tons, 19,197 tons more than in 1968.

Natural Gas.—India recorded a 20.7-percent increase in natural gas output in 1969 relative to 1968 performance. Reserves stood at 2,237 million cubic feet as of January 1, 1969 (latest data available), the same level given for January 1, 1968. Four relatively short gas pipeleines were in operation—three in the Gulf of Cambay area (two feeding power stations and one feeding a fertilizer plant) and one in the Assam area.

Petroleum.—India's petroleum industry continued to show substantial growth in almost every phase of its activities in 1969. Crude oil output was up nearly 19 percent to more than 51.7 million barrels; crude oil imports increased 1 percent to almost 78.8 million barrels; refinery throughput advanced 9.1 percent to nearly 131.4 million barrels; refinery output (excluding plant fuel and losses) increased 8.3 percent to almost 124.6 million barrels; product imports jumped 19.6 percent to more than 8.4 million barrels; and product exports registered a 27 percent growth to 6.4 million barrels.

Exploration, Drilling and Crude Oil Production.—In the field of exploration, there were no major discoveries reported in 1969, but it was indicated that preparations were nearly complete for an on-schedule start for India's deepest exploratory effort, a plus-20,000-foot hole at Suruin, 44 kilometers southeast of Jammu in the State of Jammu and Kashmir. This project, to be drilled by the Oil and Natural Gas Commission (ONGC) with U.S.-built equipment, reportedly has a good possibility for oil and gas showings at about 20,000 feet. Also of significance was the yearend near-completion of India's first offshore (shallow water) drilling platform, which was slated to be used in early 1970 for drilling to test a structure about 6 miles west of Aliabet Island in the Gulf of Cambay. Regarding deeper offshore exploration drilling of the so-called "Bombay High" structure, no concrete steps toward actual commencement of work were taken in 1969 as the Government neither accepted offers of foreign company assistance made in bids submitted in 1968, nor opted for a wholly Indian project.

At yearend 1968 (latest data available), India's crude oil reserves totaled 984.7 million barrels, 1.6 percent greater than at yearend 1967, despite the substantial increase in output. The slight growth in reserve, however, was almost wholly the result of development drilling. No complete accounting of drilling activity in 1969 is available, but ONGC reported the completion of 97 wells ("more than 640,000 feet") using 53 rigs, compared with 124 wells (947,000 feet) in 1968. Unreported was drilling by Oil India Ltd. (with four rigs operating) and Assam Oil Company (with one rig operating). Available information indicates that in all of India at

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yearend, there were about 951 producing oil wells, 79 gas wells, 113 wells under test, and 32 water injection holes in operation. Reportedly 494 dry holes have been drilled since the beginning of oil exploration in India and 340 producing wells of record have been abandoned.

Refining.—With the addition of the 50,000-barrel-per-day Madras refinery in June, India had nine operational oil refineries, with an aggregate throughput capacity of 431,200 barrels per day, and during the year produced nearly 124.6 million barrels of products, 8 percent more than in 1968, from a total throughput of almost 131.4 million barrels. Of the total refinery feed, 60 percent was imported compared with 63 percent in 1968, while the balance was of domestic origin.

Although total refinery output advanced with respect to that of 1968, four of the eight refineries that operated in 1968 registered significantly lower output on a plant by plant basis. Among the private sector refineries, only the Digboi plant of Assam Oil Company showed a marginal gain; the Burmah-Shell, ESSO, and Caltex plants registered declines that were attributed directly to the continuing controversy between the Government of India and the private firms over imported crude oil prices. As a result of this controversy, the Government about midyear initiated a program of foreign exchange restrictions on crude oil imports, which noticeably reduced such imports in the last half of the year. Among the four public sector plants operational in 1968, Barauni and Koyali registered notable gains in production for 1969, Gauhati operated close to its 1968 level, and Cochin showed an output drop as the result of a fire. By yearend, however, all facilities at Cochin had been restored and were operating at or near capacity.

The new public/private sector (Government-controlled) Madras refinery opened in June, but was not operating at capacity by yearend. Costs were reportedly exceptionally high because of delays in port improvements, which would permit 60,000-deadweight-ton (d.w.t.) tankers to provide feedstock. Until such improvements are made, the port can accommodate only tankers of less than 35,000 d.w.t.

India's 10th refinery, the joint Indian Oil Corporation-French-Rumanian venture at Haldia, remained under construction throughout the year, and completion, originally scheduled for 1971, is not expected until late 1972 or early 1973. The facility, when completed, is to be an 18.25 million barrel producer. The nation's 11th refinery, the so-called Northwest refinery, remained among planned projects, with site selection (Rajasthan, Uttar Pradesh, or New Delhi) still a matter of debate.

In addition to the full-fledged refineries mentioned above, India had two lubricating oil blending plants in operation at yearend, and the Lube India Ltd. $22.7 million lube oil base stock/light distillate processing plant near Bombay reportedly was undergoing trial runs with commissioning slated for early 1970.

Transportation.—Despite additions to India's modest pipeline system, rail transport continued to be the dominant means of moving petroleum products in India, with coastal tankers playing a significant role in product distribution along the coast. At yearend oil pipleines totaled almost 3,000 kilometers, including four crude lines with a total length of about 1,260 kilometers and four product lines aggregating about 1,737 kilometers. Construction continued on the 130 kilometer Kalol-Navagam-Haldia line, with completion scheduled for late 1970.

Marketing.—The public sector Indian Oil Corporation (IOC) increased both its level of sales on a volume basis and its share of total product distribution in India, the latter rising from 42 percent in 1968 to over 48 percent in 1969. Among the private firms, only Burmah Shell maintained its volume of sales at 1968 levels (while registering a lower percentage of total sales); all other private firms accounted for both a lower percentage of total sales and a lower quantity. The IOC increase both in quantity and share was directly related to (1) production rises by public sector refineries which market through IOC; (2) inception of operations at the new Madras refinery (which also markets through IOC); and increased sales of kerosine imported by IOC from the U.S.S.R.

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The Mineral Industry of Indonesia

By Arthur F. Grube [1] and R. A. Pense [2]

The Indonesian mineral industry made substantial progress in 1969 in production growth of important commodities such as petroleum and tin and in attracting foreign capital for future mineral development.

In the very important petroleum sector, which accounted for an estimated 3 percent of net domestic production, output of crude oil rose 23 percent. Government revenue from petroleum operations during fiscal 1969 (April 1969–March 1970) was estimated at $250 million, or roughly 28 percent of total receipts. Foreign investment in the petroleum industry in calendar 1969 was estimated at $96 million, approximately 40 percent more than investment the previous year. The conclusion of eight new petroleum exploration and development contracts during the year raised the total of such agreements in effect at yearend to about 30, involving the participation of at least 18 U.S. companies. Five contracts for nonfuel mineral prospecting and exploitation were concluded. These brought to eight the number of agreements reached since the 1967 promulgation of a basic mining law and favorable foreign investment legislation. Reportedly, these five new contracts represented an investment commitment of $330 million.

Fiscal 1969 was the first year under the new 5-year development plan (April 1969–March 1974). Total plan investment has been set at $3,500 million, of which an estimated 55 to 60 percent is to come from abroad. Approximately 44 percent of investment is to be in the priority field of agriculture, 30 percent in infrastructure, and 12 percent in industry and mining. Mining's share alone is estimated at $280 million. Crude-oil output was scheduled to rise to 440 million barrels in fiscal 1973 (April 1973–March 1974). With fiscal 1969 production reaching 293 million barrels, fiscal 1970 (April 1970–March 1971) output was targeted at 358 million barrels. The latter amount, with some new taxes, would provide the Government in fiscal 1970 with an estimated $350 million in revenue, almost 30 percent of its total income.

The principal trends in the granting of new exploration contracts in 1969 were a reduction in the time necessary for negotiating an agreement and the somewhat less favorable terms available to applicants. Among the latter was a stipulation near yearend that prior to development work foreign investors must establish an Indonesian-incorporated operating company. In the awarding of petroleum concessions, the new conditions also generally included a provision for the initiation of production bonuses at lower levels of output, reinvestment in Indonesia of part of profits, and the opportunity for some private Indonesian investment in operating companies if commercial production takes place. New legislation concerning taxation was imminent near yearend, but potential effects were not yet celar.

The first two "general mineral" exploration contracts were given to Kennecott Copper Corp. of the United States and the quasi-governmental Overseas Mineral Resources Development Co., Ltd. (OMRDC), of Japan. P. T. Kennecott Indonesia, Inc., a local subsidiary, will search for, and de-

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velop if feasible, nonfuel minerals over some 30,000 square miles. Exploration will be conducted in West Irian (18,100 square miles), where Kennecott is already drilling for copper; in south Sumatra (9,200 square miles); and in central Java (2,700 square miles). OMRDC, incorporated in Japan, will investigate about 3,900 square miles in west Sumatra. Both companies initially are being granted maximum general survey periods of 1 year, intensive exploration periods of 3 years, evaluation periods of 1 year, and facility construction periods of 3 years. In addition, Kennecott is to have an extra year for survey work in West Irian. A third, more tentative, general mineral exploration award was outlined during the year for Bethlehem Steel Corp. and Rio Tinto-Zinc Corp. Ltd. over about 15,000 square miles in west Sumatra.

Conditions for offshore petroleum exploration were considerably enhanced as the Government moved vigorously towards clarification of its marine boundaries with neighboring countries. In February a proclamation asserting Indonesia's jurisdiction over its Continental Shelf was issued in general accordance with the principles established by the 1958 Geneva Convention. By November an agreement had been concluded on the most pressing frontier, that with Malaysia, which clearly delineated their entire joint boundaries. Embodied in the understanding was the principle of using the outermost island of a country as the basis for drawing a median line when overlapping national claims existed. This principle, which favors a country of scattered islands such as Indonesia, is expected to help in projected negotiations with Australia about their mutual offshore boundaries.

The U.S. Geological Survey initiated a program of assistance to the Indonesian Geological Survey (GSI) intended to increase the number and skills of GSI personnel. Emphasis is on training and research in the fields of geophysics, geological mapping, and photogeology.

By yearend the Government's principal new mineral industry organizations, formed in mid-1968 and confirmed in late 1969, appeared to be gaining in competence and efficiency. These included P.N. Pertamina (Pertamina), which has jurisdiction over the development of petroleum and natural gas; P.N. Tambang Timah (Timah), controlling output of tin; and P.N. Aneka Tambang (Aneka), with authority over most other hard rock mining. At present Aneka supervises principally the extraction of bauxite, nickel, diamond, gold, and silver by Government enterprises, but future activities are also to be undertaken in iron sand, manganese, and copper mining. Other less important mineral-related organizations included P.N. Tambang Batubara, in charge of coal production, and P.N. Aspal Negara, handling production of rock asphalt. While the last mentioned is under the Ministry of Public Works, all other bodies are subject to the Ministry of Mining.

PRODUCTION

Output of crude petroleum, by far the most important mineral commodity Indonesia produces, vaulted 23 percent. This was largely because of the apparent success of P.T. Caltex Pacific Indonesia's program, initiated in 1967, of doubling within 2 years the 360,000-barrel-per-day production rate of its Sumatra properties. Production of tin, the country's second most significant mineral product, increased probably because of better maintenance and utilization of dredges.

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Table 1.—Indonesia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
METALS				
Aluminum, bauxite, gross weight		920,166	879,328	770,341
Gold, metal [1]	troy ounces	7,752	5,968	7,597
Lead		NA	NA	NA
Manganese ore		• 10,000	• 10,000	NA
Nickel, mine output, metal content •		5,118	7,859	6,900
Rare-earth metals, monazite sand		NA	• 25	NA
Silver	thousand troy ounces	309	309	316
Tin:				
Mine output, metal content	long tons	13,600	16,568	17,146
Metal	do.	1,481	4,885	5,898
NONMETALS				
Asbestos		r 349	NA	NA
Cement	thousand tons	• 350	411	540
Clays, kaolin		2,267	• 2,500	• 2,500
Diamond:				
Industrial •	thousand carats	6	6	6
Gem •	do.	14	14	14
Total •	do.	20	20	20
Fertilizer material, phosphate rock •		10,000	10,000	10,000
Salt, all types •	thousand tons	r 300	r 80	180
Sulfur, elemental		r 3,306	• 1,200	• 1,200
MINERAL FUELS AND RELATED MATERIALS				
Asphalt rock, bitumen content •		10,000	10,000	12,000
Coal	thousand tons	208	176	191
Gas: Natural:				
Gross production •	million cubic feet	NA	115,045	100,000
Marketed •	do.	22,000	24,066	30,161
Natural gasoline	thousand 42-gallon barrels	NA	260	NA
Petroleum:				
Crude	do.	186,231	219,912	271,001
Refinery products:				
Gasoline	do.	10,344	10,991	10,927
Kerosine and jet fuel	do.	13,419	14,317	15,948
Distillate fuel oil	do.	11,126	13,672	8,371
Residual fuel oil	do.	10,784	12,890	12,926
Other [2]	do.	18,319	15,978	24,467
Total [3]	do.	63,992	67,848	72,634

• Estimate. r Revised. NA Not available.

[1] Officially reported Indonesian statistics representing Government output; private production by small unorganized producers may be as much as 30,000 troy ounces per year.

[2] Includes unfinished oils requiring further processing.

[3] Excludes refinery fuel and losses.

TRADE

Mineral commodity exports during 1969, as in past years, continued to account for nearly one-half the value of the country's total export trade. Crude oil and refined products, estimated at $360 million, were the most significant mineral exports. Mineral commodity imports, however, accounted for only a small proportion of the country's total imports.

Japan continued as major customer for mineral exports and was a major supplier of mineral commodities to Indonesia. During 1969, Japan shipped 331,175 metric tons of cement to Indonesia, 170,774 tons of iron and steel products, 60,257 tons of manufactured fertilizer, and 1,121,000 barrels of refinery products.

The following tables contain the latest comprehensive trade data available.

Table 2.—Indonesia: Exports of selected mineral commodities to Japan [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum, bauxite	757,310	767,741
Iron and steel scrap	8,382	10,494
Manganese ore	6,233	3,140
Nickel, ore and concentrate	234,960	268,099
MINERAL FUELS AND RELATED MATERIALS		
Crude oil [2] thousand 42-gallon barrels	67,317	107,927
Distillate fuel oil do.	543	144
Residual fuel oil do.	11,641	18,385

[1] Official trade returns of Japan. Data shown in lieu of official Indonesian trade data.

[2] Includes unfinished oils.

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Table 3.—Indonesia: Exports and reexports of petroleum

(Thousand 42-gallon barrels)

Commodity	Quantity	Principal destinations, 1968
Crude oil	146,632	Japan 53,749; Australia-New Zealand 33,609; United States 23,238.
Refinery products:		
Motor gasoline	576	Australia-New Zealand 249; South Vietnam 110; Thailand 105.
Jet fuel	1,087	Virtually all to Singapore.
Distillate fuel oil	878	Singapore 700; Thailand 83; South Vietnam 71.
Residual fuel oil	5,251	Singapore 3,072; Japan 1,640; Thailand 493.
Paraffin oil distillate [1]	1,203	Japan 1,106; Netherlands 59; France 38.
Waxy residual [1]	18,499	Japan 10,923; Australia-New Zealand 3,914; Netherlands 3,112.
Other [2]	464	Australia-New Zealand 75; Hong Kong 58; Thailand 51.
Total	27,958	XX
Bunkers	391	NA.

NA Not available. XX Not applicable.
[1] Unfinished oils requiring further processing.
[2] Includes solvents, waxes, and liquefied petroleum gas.

Source: Monthly Bulletin, Petroleum and Natural Gas, Indonesia Directorate General of Petroleum and Natural Gas, 1968.

Table 4.—Indonesia: Trade in selected mineral commodities, 1967 [1]

Commodity	Quantity (metric tons)	Value (thousands)	Principal sources or destinations
EXPORTS			
Aluminum, bauxite	868,303	$7,787	Mainly to Japan.
Iron and steel scrap	17,843	752	All to Japan.
Manganese ore and concentrate	7,176	173	Do.
Nickel ores and concentrate	128,455	1,968	Do.
Nonferrous metal scrap	311	188	Mainly to Japan.
Tin:			
Ores and concentrates	16,431	38,377	All to the Netherlands.
Metal and alloys	1,688	5,662	France and West Germany.
IMPORTS			
Aluminum, metal, including alloys, all forms	4,366	8,065	West Germany and Japan.
Cement	88,010	1,347	Mainly from Japan.
Copper, metal, including alloys, all forms	1,025	1,754	West Germany and Japan.
Fertilizers, manufactured	133,658	6,255	Japan, West Germany, Netherlands.
Iron and steel, metal, including alloys, all forms	NA	24,942	Japan, West Germany, United States.
Sulfur, elemental	5,188	333	West Germany and Canada.

NA Not available.
[1] Derived from United Nations data on countries trading with Indonesia; represents bulk of mineral trade, excluding mineral fuels, but not total. Trade with Communist countries is excluded.

COMMODITY REVIEW

METALS

Aluminum.—Bintan Island, with reserves of bauxite now tentatively established at 40 million tons, remained the focus of the growing aluminum industry in 1969 despite developments elsewhere. Construction was underway at the Bintan shipping port of Kidjang to increase storage capacity from 42,000 to 90,000 metric tons, to improve loading capacity from 500 to 1,000 tons per hour, and to dredge the harbor to accommodate vessels of 30,000 deadweight tons rather than the present 20,000. Exports of Bintan bauxite in 1969 totaled 862,000 tons, most of which went to Japan. A recently signed contract calls for the shipment to Japan of 800,000 tons of bauxite in 1969 and 1970 and of 1,000,000 tons annually in the next 8 years. Three major Japanese aluminum producers—Nippon Light Metal Co., Ltd., Showa Denko Co., Ltd., and Sumitomo Chemical Co., Ltd.—already engaged in developing reserves on the island, announced tentative plans to construct a 200,000-ton-per-year alumina plant there.

On Sumatra the Indonesian Government was strongly encouraging the erection of a major reduction plant near a hydroelectric plant to be built on the Asahan River. Showa Denko and Sumitomo Chemical were among the interested parties, which included, among others, Kaiser Aluminum

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& Chemical Corp. Aluminum Company of America (ALCOA), which concluded an agreement in early 1969 to explore for and develop bauxite deposits principally in east Sumatra and west and southeast Kalimantan, apparently is not to be directly involved with the new Asahan project.

Copper.—During 1969, Freeport Indonesia, Inc., a subsidiary of the United States firm, Freeport Sulphur Company, obtained loan commitments necessary to finance its development of the Ertsberg Copper deposit in West Irian. The project's total cost is estimated at $120 million. The company has obtained loan commitments from a group of five U.S. insurance companies and seven banks for $58 million and conditional financing agreements from Japanese and West German sources for $42 million. Of the $42 million, West Germany's Kredit für Wiederaufbau will provide $22 million, and 13 Japanese copper smelting and trading companies will provide the remainder. The balance of $20 million will be provided as equity funds. Freeport Indonesia, Inc., has also signed contracts with the Japanese copper smelting companies and a leading West German smelter, Norddeutsche Affinerie, Hamburg, for the sale of copper concentrates. The Japanese firms hope to obtain 65 to 70 percent of the mine's total output for a 13-year period; the remainder will be sent to the German company.

During the year some progress was made in getting the Sanka Ropi copper project underway again. Sanka Ropi, in central Sulawesi, is known to have high-grade copper deposits, but their extent has not been ascertained. Geotechnika, a Yugoslav State-owned mining company, surveyed the area several years ago and then ceased all activities. It is reported that the Yugoslavs have now agreed to take on Indonesian and European partners for further exploration.

Gold and Silver.—All recorded gold and silver production was from the Tjikotok mine of Aneka in west Java. An exploration program was initiated at this site to uncover new reserves; present resources are believed sufficient for only about 10 more years of mining at present rates. Aneka's gold dredging project at Logas in central Sumatra was still in the stage of removing tailing overburden left from pre-World War II operations.

Iron and Steel.—At yearend, Indonesia still did not produce iron ore, pig iron, crude steel, or rolled steel. During 1969, however, five Japanese-financed projects for the construction of galvanized-sheet plants had been approved by the Indonesian Government and three were underway. The Japanese steel firm, Kawasaki Steel Corp., and a trading concern, C. Itoh and Co., Ltd., in partnership with the Indonesian company P.T. Indonesia, were building a 12,000-ton-per-year plant at Medan, Sumatra; Japan's Fuji Steel Co., Ltd., and Mitsui and Co., Ltd., in collaboration with P.T. Ragam Logam, had a 15,000-ton plant underway at Djakarta; and the Japanese companies Yawata Iron and Steel Co., Ltd., C. Itoh and Co., Ltd., and Toyo Menka Co., Ltd., had a 24,000-ton plant under construction at Djakarta.

In May a contract was signed by Aneka and Japanese interests for the shipment to Japan of 300,000 tons annually of iron sands over 5 years beginning in mid-1971. The sands, located near Tjilatjap on the south coast of Java, grade an estimated 20 to 25 percent iron. About $3 million of Indonesian funds are being expended on the project—one-third for the preparation of an open pit and for mining machinery and a preparation plant; and two-thirds for enlarging the port and loading facilities of Tjilatjap to handle 30,000-deadweight-ton vessels.

Mercury.—During the year two U.S. experts studied a recently discovered mercury deposit near the Sanka Ropi copper deposit on Sulawesi. A three-man Japanese team also visited Indonesia to study the possibility of developing mercury mines in the country. The results of these investigations were not reported.

Nickel.—The country's entire 1969 nickel ore output came from Pomalaa and Mantang Islands off southeast Sulawesi. Mining operations were conducted in a 34-square-mile area by the Japanese firm Sulawesi Nickel Development Company (SUNIDECO) under a production-sharing contract with Aneka. Virtually the entire output was exported to Japan. SUNIDECO has indicated that it will be able to provide Japan with 350,000 to 425,000 tons of nickel ore with a minimum 2.4 per cent nickel content in 1970. This would be some 30 to 60 percent more than that exported to Japan in 1969. Recent surveying has indicated the presence of 60 million tons of lower grade (down to 1.5 percent nickel) ore.

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In July the Government signed a final nickel-exploration contract, covering an area of about 15,000 square miles on Halmahera Island, with a consortium of nine Japanese metal-producing and trading companies. The Japanese firms organized the Indonesian Nickel Development Company Ltd. to commence exploratory operations in October. The new concern is committed initially to spending roughly $2 million in a 2-year prospecting program. Presently known reserves in the concession area are estimated at 2 million tons of ore with a 1.52 percent nickel content. If reserves of 50 million tons of 1.5 percent ore are established, construction of a smelter is to follow. Indonesia now has three nickel-exploration contracts in force. The other two are with the International Nickel Company of Canada, Ltd., and P.T. Pacific Nickel Indonesia, the latter a consortium of United States, Canadian, Australian, and Dutch concerns.[3]

Tin.—The Rio Tinto–Zinc Corp. Ltd–Bethlehem Steel Corp. consortium finally withdrew from negotiations with the Indonesian Government regarding an offshore tin concession. The withdrawal resulted from a Government decision to conduct such exploration on its own and followed the signing of an agreement with the United Nations Development Program. Under the agreement, Indonesia will be loaned about $1.1 million for various tin exploration activities in waters up to 30 meters deep. The Government already has let contracts totaling $300,000 for the outfitting of a new drilling vessel and for additions to existing drilling platforms and docking facilities. Funds were also being sought at yearend from the Netherlands Government for a geophysical survey in waters from 30 to 50 meters deep by Coastal Engineering Survey Consultants of the Netherlands and from the U.S. Agency for International Development for the improvement of a large dredge of U.S. origin.

All tin production came as usual from the three principal operations of Timah on Bangka, Belitung, and Singkep Islands. About 40 percent was from hydraulic mining and 60 percent from offshore dredges. At Bangka a new offshore dredge (Bangka I) with an 18-cubic-foot bucket was put into operation. At yearend Timah had 29 bucket dredges, 13 cutter-suction dredges, and five bucket-suction dredges.

Most (an estimated 11,000 long tons) of the tin-in-concentrate produced was again shipped to Malaysia for smelting. Output from the new (1967) refinery at Muntok on Bangka increased as operators overcame problems involving faulty refractories. About 9,973 long tons of concentrates was smelted in 1969 to produce 5,898 tons of metal. The plant's annual output capacity, originally announced as 25,000 tons, allegedly is only 15,000 tons because of faulty design.

Uranium.—A 7-year agreement for uranium prospecting in Kalimantan was signed in April between France's Commissariat à l'Énergie Atomique (CEA) and the Indonesian Government. Should any commercial discoveries be made in this unexplored area, CEA would have exclusive development rights. At yearend Japan's Overseas Mineral Resources Development Co., Ltd. reportedly was making arrangements for uranium exploration in west Sumatra.

NONMETALS

Cement.—Greater demand and fuller utilization of both old and new plants contributed to the significant rise in production in 1969. Output from the Gresik plant near Surabaja in east Java was about 323,000 tons, a 5-year high. The new Tonasa plant at Makasar in Sulawesi appeared to be operating at 75 to 80 percent of its 120,000-ton-per-year capacity during the first 9 months of the year. Most of the remaining output was believed to have come from the 150,000-ton Padang plant at Ingarung in west Sumatra.

As part of its overall 5 year development plan, the Government has announced intentions of producing 1,250,000 tons of cement in 1973 to achieve national self-sufficiency. All basic materials for cementmaking except gypsum reportedly are readily available, and a research program aimed at producing an artificial gypsum has been initiated. Orders for six, small-scale, shaft-kiln cement plants were tentatively placed with an Indian firm, the Industrial Development Corp. of Tamil Nadu. These would augment an undetermined number of other small plants now scattered around the country.

Diamond.—Although long-idle equipment was finally installed, no output was reported from Aneka's project to recover

[3] For details, see 1968 Minerals Yearbook.

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diamonds by mechanical means from gravels in the Simpang Ampat-Pengaron area of southeast Kalimantan. All of Indonesia's estimated 1969 diamond production again came from private producers in Kalimantan, particularly southeast Kalimantan.

Fertilizer Materials.—During 1969 the urea plant based on natural gas, at Palembang in Sumatra, Indonesia's only fertilizer plant, operated at roughly 85 percent of its 100,000-ton-per-year capacity. Plans formulated between the Japan Ammonium Sulphate Industry Association and Pertamina for manufacturing nitrogenous fertilizers from natural gas were abandoned in favor of the construction of a complex-fertilizer plant at either Djakarta or Surabaya in Java or Medan in Sumatra.

MINERAL FUELS

Coal.—Although production rose somewhat during the year and costly excess personnel continued to be pared, lack of fresh capital needed to purchase new equipment threatened the very existence of P.N. Tambang Batubara's three operations at Bukit Asom and Ombilin on Sumatra and Mahakam in east Kalimantan. No particular progress was reported on the project to modernize the Ombilin mines with Polish machinery. Allegedly, demand continued to exceed supply, and a contract to ship 100,000 tons of coal to Taiwan had to be cancelled. The principal consumers of coal in 1969 were the Government railways on Sumatra (68,000 tons), the Padang cement plant (52,000 tons), and the mines themselves (40,000 tons).

Petroleum.—Output from Indonesia's 40-odd producing oilfields jumped to an alltime high of 271 million barrels in 1969, principally because of increases from fields of P.T. Caltex Pacific in central Sumatra. These fields, of which Minas remained by far the most important, produced 218 million barrels or 80 percent of the total. P.T. Stanvac Indonesia's fields in central and south Sumatra, including the substantial Duri field, contributed an additional 17 million barrels. The scattered Java, Kalimantan, and Sumatra fields of Pertamina accounted for the remaining 36 million barrels.

Output from the seven refineries and two asphalt plants increased at a more modest rate but still reached a 4-year high. At yearend negotiations were reaching conclusion for the sale of P.T. Stanvac's Sungaigerong refinery in Sumatra to Pertamina, which would make the latter the nation's sole refiner. In addition, two more refineries were under construction in central Sumatra for Pertamina. Completion of the 100,000-barrel-per-day refinery being built by a group of Japanese companies at Dumai and the 25,000-barrel refinery being erected at Pakning by Refining Associates Canada Ltd. will increase by nearly one-half the country's persent 270,000-barrel per-day capacity.

During the year, Pertamina continued to invite bids from oil companies interested in securing exploration and/or development contracts. Nine areas were opened for bidding. At least eight of the production-sharing agreements required by Pertamina of concession holders were concluded.

The contracts awarded were briefly as follows: To Jenny Manufacturing Co., which signed for itself and three other companies (State Marine Lines Inc., Santa Fe International, and Canada's Syracuse Oils Ltd.), two contracts, one for approximately 17,200 square miles on and around Karimata off eastern Sumatra and the other for about 25,600 square miles in the Mentawi Islands, off western Sumatra; to Dearborn Computer and Marine Corp., in partnership with Storm Drilling Co. and one other U.S. company, for approximately 23,000 square miles on and off Halmahera in the Molucca Islands; to Asia Oil Corp.—a joint operation of the White Shield Corp. of Canada (a U.S.-owned and U.S.-incorporated concern) and the Kenneth McMahon group of Australia—for about 20,000 square miles off western Sumatra and southern Java; to Gulf Oil Corp. in partnership with Western Industries Inc. for 50,000 square miles on and surrounding Ambon, Buru, Ceram and Sula in the Molucca Islands; and to Compagnie Française des Pétroles for approximately 4,600 square miles adjacent to an onshore and offshore concession obtained by the company the previous year in north Sumatra.

In addition, the Royal Dutch/Shell Corporation returned to Indonesia after an absence of 4 years and signed for about 12,500 square miles in east Kalimantan. After extended negotiations the Southeast Asia Oil and Gas Company finally was awarded approximately 38,600 square miles off southern Sulawesi. An announcement

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that Pakistan National Oil Co. (a private concern) had acquired a 50-percent interest in Southeast Asia followed almost immediately. Unreported previously was the contract signed in late 1968 with Agip S.p.A., a subsidiary of Ente Nazionale Indrocarburi, for about 41,400 square miles off Kalimantan.

By the end of 1969, two concession holders had been successful in finding new offshore oilfields. Japex Indonesia Ltd. found oil off Idi in north Sumatra despite some drilling difficulties. Tests indicated that one well has three producing zones of limestone between 8,600 and 9,600 feet and a total production capability of up to 5,500 barrels daily of high gravity (45° API), low-sulfur (0.04 percent) crude oil. Japex hopes to begin commercial production in 1970. The other discoveries, off northwestern Java, were made by a consortium headed by a subsidiary of Atlantic Richfield Co., the Sinclair Exploration Co., and a subsidiary of Natomas International Co., the Independent Indonesian American Petroleum Company. Five Exploratory wells found high-gravity, low-sulfur crude oil at relatively shallow depths. In general, the area contains nine producing zones (apparently all sandstone) between 2,200 and 3,800 feet. During tests, production of crude oil, which ranges from 37° to 40° API, reached 2,600 barrels per day.

At yearend there were five drilling ships operating in Indonesian waters.

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The Mineral Industry of Iran

By David A. Carleton [1]

Although the expansion of Iran's economy slowed slightly in 1969 after 5 years of exceptionally rapid growth, the mineral industry, led by petroleum, continued to make substantial gains. Accordingly, the mineral industry, as well as the economy as a whole, continued to be supported by the petroleum (including natural gas) industry. In 1969 the petroleum sector accounted for about 85 percent of the country's foreign exchange earnings, contributed 17 percent of the gross national production (GNP), and provided $1.1 billion in Government revenue. The Government's policy of encouraging foreign capital investment and foreign expertise, together with a longstanding stable political situation, has contributed significantly to Iran's economic successes in recent years.

Most of the large mineral-oriented enterprises are owned in part by the Government. Because of the heavy commitment of public funds to new establishments during recent years, together with escalating costs of projects underway, no new major mining or mineral projects were undertaken during 1969. Exploration and evaluation of the large Sar Cheshmeh porphyry copper deposits, perhaps the most promising mining prospect in Iran, continued during the year. At yearend 1969, further development of the deposits was awaiting the conclusion of financial arrangements.

A new mining law has been drafted and is expected to be submitted to the Parliament and, if approved, will take effect late in 1970 or early in 1971. The provisions of the new law are expected to improve opportunities for foreign investment in Iran.

[1] Supervisory foreign mineral specialist (Petroleum), Bureau of Mines, Washington, D.C.

PRODUCTION

Other than for petroleum and natural gas, the Iranian Bureau of Statistics has not collected statistical data on mineral production since the Iranian year 1341 (March 21, 1962 to March 20, 1963). The figures given in table 1 are highly arbitrary, representing extrapolations and, in some cases, estimates based on exports. The Bureau of Statistics has reported that a new survey of mineral production for the Iranian year 1348 (March 21, 1969 to March 29, 1970) was underway in May 1970.

Iran continued in 1969 as the world's fourth largest crude oil producer and the Middle East leader. At yearend, Iran was strongly challenging Venezuela for third position. Total Iranian crude oil production in 1969 averaged 3,374,472 barrels daily, up 18.5 percent from 1968. The value of crude oil production in 1969 was about $1.7 billion based on estimated realized prices.

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Table 1.—Iran: Production of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
METALS				
Chromite		r 110,000	90,000	140,000
Copper ore (3 to 8 percent copper)		12,000	12,000	12,000
Lead:				
Ore (6 to 60 percent lead)		37,000	37,500	50,000
Ingots (smelter output)		350	350	350
Magnesite		6,000	6,500	6,500
Manganese (averages 40 percent manganese)		42,000	r 12,000	35,000
Zinc (5 to 60 percent zinc)		89,000	90,000	45,000
Zinc and lead (12 percent lead, 30 to 40 percent zinc)		20,000	20,000	45,000
NONMETALS				
Barite		90,000	95,000	70,000
Cement, hydraulic	thousand tons	1,395	1,400	2,342
Gypsum	do.	1,093	982	2,000
Ochre		9,500	9,700	8,000
Salt	thousand tons	259	275	310
Sulfur		36,600	38,000	40,000
MINERAL FUELS AND RELATED MATERIALS				
Coal	thousand tons	290	300	250
Coke	do.	21	21	50
Natural gas	million cubic feet	709,238	802,490	960,328
Marketed	do.	51,784	55,534	98,201
Petroleum:				
Crude (net) [2]	thousand 42-gallon barrels	947,678	1,039,366	1,231,828
Refinery products:				
Aviation gasoline	do.	6,477	6,533	6,475
Motor gasoline	do.	12,859	15,818	16,998
Naphtha and solvents	do.	3,018	2,964	4,934
Jet fuel	do.	10,343	12,617	13,428
Kerosine	do.	14,220	17,579	19,682
Distillate fuel oil	do.	23,250	27,390	29,831
Residual fuel oil	do.	73,947	72,939	76,842
Lubricants	do.	327	448	560
Asphalt	do.	1,965	1,654	2,243
Liquefied petroleum gas	do.	447	530	930
Other	do.	8,180	9,251	e 3,791
Total	do.	150,033	167,723	175,714
Refinery fuel and loss	do.	9,555	11,742	e 14,500

e Estimate. p Preliminary. r Revised.

[1] Except for natural gas and petroleum, data are for the calendar years beginning March 21 of the year indicated. Except for petroleum and natural gas, data are "guesstimates" of either the U.S. Bureau of Mines or the Iranian Bureau of Statistics of the Ministry of Economy.

[2] Excludes petroleum reinjected into the fields.

TRADE

Petroleum continued as Iran's principal export commodity, having an f.o.b. value of $1.8 billion and representing 88 percent of total exports. The direction of petroleum export trade has shifted considerably in recent years, the result of increased crude oil production in Libya and the growing demand in Far Eastern markets. The trading companies of the Consortium (Iranian Oil Exploration and Producing Co. and the Iranian Oil Refining Co.), which accounted for 91 percent of total petroleum exports in 1969, marketed 60 percent of their shipments in the Far East (mostly in Japan) and 24 percent in Western Europe. In 1966 these areas received 41 and 39 percent, respectively.

About three-fourths of the $10 million worth of nonpetroleum mineral exports during the Iranian year ending March 20, 1969, were represented by lead, zinc, chromite, and cement. During that year the decline in the value of all nonfuel mineral exports but lead, was offset by a nearly equal increase in value of lead exports.

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Table 2.—Iran: Exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Chromite, 48 percent Cr_2O_3	88,770	62,128	United States 11,500; France 9,865; Netherlands 8,870.
Iron and steel, metal:			
Scrap	3,524	25,883	All to mainland China.
Semimanufactures	449	359	Kuwait 188; Afghanistan 124.
Lead, ore and concentrate	47,485	36,177	U.S.S.R. 28,141; Japan 8,036.
Manganese ore	10,825	32,800	Japan 16,800; Hungary 14,800.
Zinc, ore	40,122	51,112	Japan 24,177; U.S.S.R. 15,511; Bulgaria 8,000.
NONMETALS			
Barite, natural	3,027	10,090	Kuwait 6,065; Saudi Arabia 1,824; U.S.S.R. 879.
Cement	54,593	42,153	Muscat and Oman 29,823; Kuwait 12,329.
Chalk	166	352	United States 250; Muscat and Oman 70.
Clay	3,134	12,284	Kuwait 4,794; Saudi Arabia 2,638; Trucial States 2,156.
Fertilizers	12	7	All to Kuwait.
Gypsum	3,004	1,942	Kuwait 1,686; Muscat and Oman 255.
Lime	NA	1,901	Kuwait 1,653; Republic of South Africa 248.
Pigments, ochre and earth colors	4,150	4,139	United Kingdom 2,000; France 1,500; India 539.
Salt	3,199	4,720	Kuwait 4,278; Muscat and Oman 420; Qatar 11.
Stone:			
Dimension:			
Marble	4,180	9,160	Italy 6,428; Kuwait 1,158; Japan 366.
Other	3,960	5,026	Kuwait 1,468; West Germany 1,374; Italy 1,166.
Crushed	40,792	48,709	Kuwait 39,572; Muscat and Oman 7,585; Trucial States 1,107.
MINERAL FUELS AND RELATED MATERIALS			
Coal and lignite	153	288	Iraq 213; Kuwait 75.
Petroleum:			
Crude oil—thousand 42-gallon barrels	783,527	885,663	Japan 360,236; United Kingdom 185,095; Republic of South Africa 33,691; Netherlands 31,487.
Refinery products:			
Aviation gasoline—do	7,720	6,437	Singapore 2,950; Australia 429; Republic of South Africa 395; Kenya 283.
Motor gasoline—do	11,219	17,620	United Kingdom 2,752; Singapore 1,888; Mozambique 1,585; Brazil 1,230.
Jet fuel—do	7,422	10,497	Singapore 1,871; United Kingdom 1,635; United States 824.
Kerosine—do	3,984	6,169	Republic of South Africa 1,216; Pakistan 797; Mozambique 764.
Distillate fuel oil—do	9,471	11,751	Singapore 1,811; Pakistan 1,166; Angola 1,098.
Residual fuel oil—do	62,993	73,475	Japan 30,528; United Kingdom 10,322; Hong Kong 4,247; Singapore 3,159.
Solvents—do	785	156	Republic of South Africa 66; Singapore 36; Australia 22; Mozambique 14.
Asphalt—do	561	415	Muscat and Oman 203; Trucial States 51; Kuwait 25.
Other—do	915	350	Mozambique 92; Australia 59; Hong Kong 51; Republic of South Africa 47.
Total—do	105,070	126,870	

NA Not available.

[1] Data are for Iranian calendar years beginning March 21 of the year indicated.

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Table 3.—Iran: Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum and alloys:		
Unwrought	4,620	5,782
Semimanufactures	2,855	3,526
Copper, metal, including alloys:		
Unwrought	5,074	3,162
Semimanufactures	7,869	6,687
Gold, troy ounces	32,376	16,300
Iron and steel, including alloys:		
Cast iron and ferroalloys	23,692	26,319
Scrap	5,170	6,030
Unwrought	3,078	8,633
Semimanufactures	1,211,191	1,357,726
Lead:		
Oxides	238	694
Metals, including alloys:		
Unwrought	3,368	3,570
Semimanufactures	531	46
Nickel, all forms	229	152
Platinum, troy ounces	648	482
Silver, do	113,910	39,706
Tin and alloys:		
Unwrought, long tons	277	225
Semimanufactures, do	352	322
Titanium	934	1,254
Zinc:		
Oxide	620	550
Metal, semimanufactures	1,946	229
NONMETALS		
Abrasives	1,090	948
Asbestos	5,804	5,914
Cement, thousand tons	40	51
Clay	11,743	11,924
Fertilizer materials, manufactured:		
Nitrogenous	6,979	20,480
Phosphatic	51,291	28,715
Potassic	18,213	29,180
Mixed	4,973	15,480
Graphite	124	415
Gypsum	949	378
Lime	733	142
Magnesite	127	227
Mica, all forms	147	253
Quartz	111	104
Salt	113	46
Stone, crushed	354	148
Sulfur	386	661
Talc	293	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Lubricants, thousand 42-gallon barrels	40	47
Other, do	20	20

NA Not available.
[1] Data are for Iranian calendar years beginning on March 21 of the year indicated.

COMMODITY REVIEW

METALS

Aluminum.—Construction of a 45,000-ton-per-year aluminum smelter at Macron Arak began in 1969. The plant, which is being built by Klockner-Humboldt-Deutz, A.G. and partners, will be owned by Iranian Aluminium Co., Ltd. (Iralco). Reynolds Aluminum Co., a 20-percent partner in Iralco, is furnishing engineering and operational expertise.

Output will consist of aluminum and aluminum alloy ingots and wire bars made from imported aluminum oxide. The plant includes 280 electrolytic cells arranged in two circuits, each of which is operated on 70,000 amperes with discontinuous and baked anodes. Imported aluminum oxide will be unloaded at Bandar Shahpur at the head of the Persian Gulf and transported by rail in special cars to the plant.

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When completed in 1972, an estimated 15,000 tons per year will be for domestic consumption. The company has already contracted to supply Pakistan with 10,000 tons annually.

Copper.—The recently discovered porphyry copper belt in Southeastern Iran (about 40 miles west of Kerman) extends about 30 miles in length with two major centers. Sar Cheshmeh, the deposit about which most is known, is one of four deposits in the southeastern end of the belt. Another six deposits are located to the northwest.

Exploration and development of Sar Cheshmeh during recent years has been active. During 1968 and 1969, 160 diamond drill holes, having an accumulated depth of 82,000 feet, were completed and several thousand feet of adit were driven. In addition, a pilot plant was built and several thousand tons of ore was milled to determine its metallurgical characteristics. Reportedly, the ore contains 0.027 percent molybdenum.

Reserve calculations and open-pit mining plans were completed in 1969. Accordingly, reserves to a depth of 500 feet are set at 350 million tons of 1.2 percent sulfide copper, which can be mined with a low stripping ratio. In addition, there are 20 million tons of higher grade oxide copper. An additional 450 million tons of reserves occur between 500 and 800 feet in depth.

In October 1969, water was found 30 miles from the mine sufficient to support a 30,000-ton-per-day mill which, in turn, could produce 140,000 tons of blister copper per year. The initial cost of establishing such an operation is expected to be about $250 million; however, financing the project remains in question. At yearend 1969, Iranian Selection Trust, Ltd., which owns 49 percent of the venture, was completing economic studies, and sources of finance were being investigated. Kerman Mining Co. (owned by the Rezai family) holds the remaining 51 percent of Kerman Copper Industries, Ltd.[2]

Iron and Steel.—Construction continued on Iran's first integrated steel mill now being built with U.S.S.R. assistance near Isfahan. However, according to official Soviet press releases, the initial raw steel capacity will be only 350,000 tons per year compared with the previously reported 500,000 to 600,000 tons per year. Furthermore, the size of each of the two oxygen converters is now given as 80 tons, slightly smaller than the 100 tons originally mentioned. Reportedly, construction of the plant is on schedule and should be completed in 1971. A contract has been signed to raise the plant's capacity to 1,500,000 tons annually. The whole plant is being financed by the U.S.S.R. in return for deliveries of natural gas and agricultural products from Iran. About 300 Soviet experts are assisting in the construction.

Iran's two unit rolling mill completed its first full year of operation in 1969. A continuous wire rod finishing train was added during the year. Production from the light section mill was set at 65,000 tons per year, broken down as follows, in tons per year: Rounds, 31,000; angles, 20,000; tees, 5,000; and flats, 9,000. These products are produced from imported billets 60 by 60 millimeters and 80 by 80 millimeters.

The second unit, a merchant bar bill, is designed to produce reinforcing bars 8 to 28 millimeters in diameter from imported billets. The mill's rated capacity is 85,000 tons per year, of which 50,000 tons per year can be twisted. As in the case of the first mill, capacities are calculated on two 8-hour shifts working 300 days per year. Operating results of the two mills are reported as very satisfactory.

After experiencing some start up problems in 1968, the Ahwaz Pipe Mills completed a successful year of operation in 1969. Through 1969, the mills had delivered 110,000 tons of pipe. Of this, 75,000 tons was supplied to the Iran Gas Trunkline, 5,000 tons were exported, and the remainder was sold to National Iranian Oil Co. (NIOC) and the Consortium. At the beginning of 1970, Ahwaz Pipe Mills had orders for 50,000 tons of 6- to 16-inch pipe and negotiations were underway with the U.S.S.R. and Pakistan for the export of about 100,000 tons of large diameter pipe.

The two plants at Ahwaz Pipe Mills, one for 6- to 16-inch pipe and the other for 18- to 42-inch pipe, were built at a cost of $16.3 million. Plans are to build another unit for the manufacture of pipe with diameters from ½ to 4 inches.

Lead-Barite.—Details of the Ravandje lead-barite operation of Sogemiran, S.A., near Delijan were published recently.

[2] World Mining. V. 5, No. 13, December 1969, pp. 7–8.

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Three main ore bodies have been discovered so far. The largest, which was mined years ago, is now being openpit mined. The second is being developed by sublevel caving, while the third will be developed later. The ores are a series of lenses of varying sizes. Where the lenses are close enough together, they form minable ore bodies. They contain 3.0 to 20.0 percent lead with the average about 6.5 percent. Oxide lead is often more than 50 percent of the total lead. Gangue materials are calcite and barite. When market conditions are proper, the barite is economically recoverable. Since the Suez Canal has been closed, barite prices in the Persian Gulf area have been high enough to warrant barite recovery.

Ore from the blending yard is trucked a short distance to the flotation mill where it is crushed, ground, and then separated at two double banks of flotation cells having a total capacity of 250 tons per day. The lead concentrate is bagged and trucked to Bandar Pahlavi on the Caspian Sea for shipment to the U.S.S.R. The barite is trucked to a grinding and mixing plant just south of Tehran. Owned by Macgobar Co., the plant produces heavy drilling mud for oilwell drilling.[3]

Lead-Zinc.—Iran's major lead-zinc operation is at Bafq in central Iran. The deposit is owned 49 percent by the Rastegar Brothers (Iranian nationals), 34 percent by Société Minière et Métallurgique de Peñarroya, S.A., and 17 percent Rio Tinto-Zinc Corp., Ltd. Although data on the size of the deposit are not available, the mine's flotation plant can handle 400 tons of ore per day and can produce 200 tons daily of 60-percent concentrate. The concentrates are trucked to Khorramshahr; however, tentative plans are to make shipments through Bandar Abbas when feasible.

There are two other lead-zinc deposits similar in size to that at Bafq—one near Isfahan and the other near Qum. They are operated by, but not owned by, the Rastegar Brothers. These mines have not reached the stage of development as the Bafq mine because of apparent disinterest of foreign investors.

The Rastegar Brothers also own another lead-zinc mine located near Zanjan in northwestern Iran. The mine is the open pit type and the ore is heavily oxidized. All the production is exported to the U.S.S.R.

NONMETALS

Sulfur.—A U.S. company, Tenneco Oil Co., entered a joint venture with Industrial Development and Renovation Organization, an Iranian Government agency which holds the controlling 55 percent interest. The new group will explore for sulfur along the Persian Gulf coast in 16 areas, totaling 158,000 acres. Extensive surface exploration was performed in 1969, and geophysical work was scheduled to start early in 1970, to be followed by core drilling.

MINERAL FUELS

Natural Gas.—Construction of four plants for the extraction of natural gas liquids from gas supplied to the Iran Gas Trunkline (IGAT) were completed during 1969. The plants will process 1,260 million cubic feet of gas per day and make some 33,000 barrels per day of liquid condensate. Three of the plants are in Agha Jari oilfield with a total capacity of 560 million cubic feet daily and the fourth in Marun oilfield with a capacity of 700 million cubic feet daily.

Initially dry, sour gas available to IGAT at Bid Boland from these plants will amount to 1,160 million cubic feet daily; this volume will increase to 1,710 million cubic feet per day in 1971–72 when two more plants are constructed.

The natural gas liquids mix from Marun is transported in a 12-inch line a distance of 30 miles to Agha Jari where it connects to the line to Bandar Mah Shahr. The Agha Jari and Marun natural gas liquids mix is transported to Bandar Mah Shahr through a 48-mile, 12-inch line at an input pressure of 400 to 800 pounds per square inch, gage and a delivered pressure of 450 pounds per square inch, gage. The line was formerly used for fuel gas and crude oil. Facilities recently completed at Mah Shahr include a 58,000-barrel-per-day fractionation unit which has an output capacity (in barrels per day) of

[3] World Mining. V. 6, No. 4, April 1970, pp. 16–19.

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the following: propane, 14,260; butane, 15,040; and pentane plus, 18,200.

Work continued during 1969 on the IGAT scheduled for completion in 1970. The 1,900-kilometer gasline system (including collection, trunk, and principal distribution lines) will be able to deliver gas from the Bid Boland treatment plant at a maximum rate of 1,050 million cubic feet to the U.S.S.R. by 1975 and 579 million cubic feet per day to Iranian users by 1979.

Natural gas consumption (marketed production) made a significant gain in 1969, because of the completion of petrochemical plants on Kharg Island and at Abadan. Feedstock for the former plant is gas from Darius Kharg field. The plant has a daily capacity to produce 600 tons of sulfur, 5,000 barrels of natural gas liquids, and 2,000 barrels of light oils. All of the natural gas liquids production for 10 years will be shipped to Japan. The sulfur production will be exported to India, Republic of South Africa, and Australia. The plant is owned 50 percent by National Petrochemical Co. (NPC), a wholly owned subsidiary of NIOC, and 50 percent by Standard Oil Co. (Indiana). The Abadan plant, owned 74 percent by NPC and 26 percent by The B. F. Goodrich Co. has an annual capacity to produce 24,000 tons of caustic soda, 20,000 tons of polyvinylchloride, and 10,000 tons of dodecyl benzene. Feedstock is gas from the Abadan refinery. Currently it appears that the domestic market will consume all of the production except for some of the caustic soda that will be exported.

Iran's largest petrochemical plant, the Shahpur plant owned by the Shahpur Petrochemical Co. (50 percent NPC and 50 percent Allied Chemical Corp.), is expected to be completed near the end of 1970. The plant will use imported phosphate rock and natural gas delivered from Masjid-i-Suleiman oilfield via a 108-mile, 20-inch pipeline. Initially the plant will produce the following, in tons per day: Ammonia, 1,000; sulfur, 1,500; sulfuric acid, 1,300; urea, 500; phosphoric acid, 450; and diammonium phosphate, 380 (or triple superphosphate 430).

The plant will supply both the domestic and foreign market. Uniquely, much of the output will be marketed in intermediate forms of anhydrous ammonia and sulfur rather than as finished fertilizers.[4]

Petroleum.—The Consortium continues to be the major oil producing and refining company in Iran accounting for 92 and 83 percent, respectively, of the country's total crude production and refining. The Government corporation, NIOC, has grown in importance and is now a fully integrated company within Iran. Companies which have joint ownership of petroleum production with NIOC are Iran Pan-American Oil Co. (IPAC), Société Irano-Italiènne des Pétroles (SIRIP), Lavan Petroleum Co. (LAPCO), and Iranian Marine International Oil Co. (IMINOCO). Companies which have contractual agreements with NICO are Société Française des Pétroles d'Iran (SOFIRAN), Association de Recherche et d'Exploration du Pétrole d'Iran (AREPI), and Continental Oil Co. (CONOCO).

Iran's two-way proposal to Pakistan for a joint exploration and producing venture in Iran and a refining arrangement in Pakistan was advanced at the chief-of-state level in 1969. Communiques directed officials in both countries to expedite finalization of technical and financial details so that formal agreements could be concluded at an early date.

Consortium.—The significance of the 1968 oil discovery, Maleh-Kuh oilfield, was confirmed by the drilling of another well 15 kilometers to the northeast into the Sarvak reservoir. The well drilled to 6,312 feet substantiated a two-zone oil reservoir with a combined thickness of 1,500 feet. The well was completed for 17,000 barrels per day of a light, low-sulfur crude. An exploration well drilled at Karun tested 1,500 barrels daily of medium weight oil. Drilling on Qeshm Island in the Persian Gulf resulted in a natural gas find. The well tested at 5 million cubic feet per day.

Major development drilling efforts were concentrated at Marun and Paris fields where as many as three rigs were drilling in each field at one time. In all areas a total of 23 development wells were drilled, of which 15 were oil producers, adding 580,000 barrels per day to potential production.

Average daily production in 1969 reached 3,108,031 barrels per day for an increase of 14 percent over the previous year. The greatest increase was at the Marun field which rose 37 percent during

[4] Iran Oil Journal. No. 136, January 1970, pp. 10–12.

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the year. During April 1969, total accumulated production since 1908 by the Consortium and its predecessors passed the 10 billion barrel mark.

At the Kharg Island crude oil export terminal, now the world's largest, modifications were made during 1969 to enable the terminal to handle tankers up to 250,000 deadweight tons. During the year the terminal achieved a single-day export loading record of 5,190,000 barrels. Storage at Kharg Island totaled 11,180,000 barrels; two 1 million barrel tanks are in the course of construction. A decision has been made to construct an additional two-berth sea-island type jetty capable of handling tankers of 500,000 deadweight tons.

Crude oil processed at Abadan averaged 409,476 barrels per day during 1969. Changes in operating parameters enabled certain units to operate more efficiently increasing output and reducing catalyst loss to a new low. A new continuous asphalt blowing unit with a capacity of 15,000 metric tons was completed during the year.

In 1969, capital investment in Iran by Consortium members total an equivalent of $94 million. This together with internal operating expenditures, income taxes, and other payments contributed an equivalent of $992 billion to the foreign exchange earnings of Iran in 1969.[5]

NIOC.—Drilling by the Government-owned company in northeastern Iran confirmed that the Khangiran field has gas reserves totaling 18 trillion cubic feet. Exploration drilling continued in Gorgan, Dasht-e Moghan, and along the Caspian Sea coast.

Production from Naft-e Shah oilfield, the only field NIOC operates independent of others, totaled an average of 9,317 barrels per day in 1969, essentially unchanged from 1968. Construction began on a new line from the field to Kermanshah during the year. In addition, the project to renovate the Kermanshah refinery is nearing completion and is scheduled for operation in the latter part of 1970.

Refinery throughput at the Tehran plant, which completed its first full year of operation, averaged 75,100 barrels daily in 1969. During the year several new products, such as aviation gasoline and special naphthas were produced and plans were prepared for the construction of a 700,000 barrel-per-year lube plant. Furthermore, plans were confirmed for the construction of a 40,000-barrel-per-day refinery at Shiraz.

Throughout the year there was continuing speculation and discussion about NIOC's proposal to build a 1,000-mile pipeline from Ahwaz to the Mediterranean port of Iskenderun, Turkey. The proposed line has been stated to be 42 inches in diameter and to have a capacity of 1.4 million barrels per day. United States and French construction firms are arranging for financing the line; however, realization of the financing agreements hinges on a guarantee by the Consortium members to use 900,000 barrels per day of the capacity. The latter point has not yet been resolved.

NIOC's exports of "barter crude" to Eastern Europe averaged 31,009 barrels for 1969. The oil, which is shipped from Kharg Island, is oil which the Consortium is making available to NIOC through 1971 for barter arrangements with specified East European countries. All of the 1969 shipments are presumed to be shipped to Rumania. NIOC is entitled to 100,000 barrels daily in 1970.[6]

IPAC.—This company produced 37,881,000 barrels in 1969 from Darius and Cyrus fields, essentially the same as in 1968. Although the company could produce more, it has been reluctant to do so until it reaches a pricing agreement with NIOC. When the prices are settled, IPAC will begin an expansion program which will include production from what might be the Persian Gulf's largest field, Fereidoon-Marjan, this field straddles the offshore Iran-Saudi Arabia boundary. The way was opened to produce from this field by a settlement of the disputed boundary which bisects what is conservatively estimated to be a 10 billion barrel reserve.[7] The company's fourth field, Esfandiar, just north of Fereidoon-Marjan is being evaluated as is its 1968 discovery, Kurosh, west of Kharg field. Esfandiar is believed to be capable of 50,000 barrels per day.

SIRIP.—SIRIP nearly doubled its production in 1969 to a total of 9,732,000 barrels. All of the production was from offshore Bahregansar field. Production of the new Nowruz field is expected in 1970 at a rate of 60,000 barrels per day. SIRIP

[5] Iranian Oil Operating Companies. Annual Review, 1969, pp. 4–12.
[6] Petroleum Intelligence Weekly. V. 9, No. 6, Feb. 9, 1970, p. 7.
[7] Petroleum Intelligence Weekly. V. 8, No. 45, Nov. 10, 1969, p. 3.

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is also conducting development drilling at the Hendijan find 20 kilometers northeast of Bahregansar, and at Kuh-e Rig and Dudrov in the Zagros Mountains. Together they could add 85,000 barrels daily.

LAPCO.—In 1969 LAPCO was the largest offshore producers in Iran with output of 13,552,000 barrels. During the year LAPCO expanded tanker loading and pipeline facilities and made extensive reservoir studies. An arrangement was made to share facilities with IMINOCO which also operates on Lavan Island. LAPCO agreed on a posted price with Government officials at the end of 1969 and accordingly exports are expected to increase considerably during the year.

During the early part of 1969, NIOC had difficulty marketing its share of production from the joint venture. During the last 3 months, however, the Government successfully lifted about 80,000 barrels of Sassan crude destined for Spain.

IMINOCO.—IMINOCO began production in August 1969, producing a total of 5,583,000 barrels from Rostam oilfield. At yearend the company was producing about 60,000 barrels daily. In July, 1969 Phillips Petroleum Co., operator of the concession, announced the discovery of oil on a second site in their concession area. The well, called Rakhsh, flowed at 5,250 barrels daily of 35° API gravity oil and is located on a structure 17 miles northeast of the new Rostam oilfield. By the end of 1969 IMINOCO was completing two development wells and planning for 1970 included six more wells and a 100,000-barrel-per-day pipeline from Rakhsh to tanker facilities.

SOFIRAN.—Exploration and drilling by this company, a wholly owned subsidiary of the French government company, Entreprise de Recherches et d'Activitiés Pétrolières (ERAP), continued in both its onshore and offshore concession area. The first well drilled onshore in the Kavir-e Lut found oil in quantities not yet announced. Drilling is to continue. At Sarri in the offshore concession area, stepout drilling is being performed to determine if the field has commercial reserves.

AREPI.—On March 3, 1969, NIOC officials signed a "contractor-type" agreement with a consortium of five European petroleum companies. The consortium corporate name is Association du Recherches et d'Exploration des Pétroles d'Iran (AREPI). Its equity shares are owned as follows: (ERAP), 32 percent; Ente Nazionale Idrocarburi (ENI), an Italian Government company, 28 percent; Hispanica de Petroleos, S.A. (Hispanoil), the Spanish Government-controlled company, 20 percent; Petrofina, S.A., a private Belgian firm, 15 percent; and Oesterreichische Mineraloelverwaltung, A.G (OeMV) the Austrian State oil company, 5 percent. The agreement covers 27,260 square kilometers south of Shiraz and is part of the area relinquished by the Consortium in 1967. Similar to other contractor-type agreements, the Iranians make no financial investment but will receive 55 percent of the oil produced up to a rate of 275,000 barrels per day and 70 percent of the oil produced in excess of this amount. Fifty percent of recoverable reserves will be set aside as national reserves for NIOC use.

CONOCO.—An agreement between Continental Oil Co. and NIOC for exploration and development of a 5,000-square-mile area near the port of Bandar Abbas in southern Iran was ratified by the Iranian Government during 1969. The terms require CONOCO to spend $4 million for exploration during the first 3 years. In the event of a discovery, NIOC will pay 50 percent of the exploration. CONOCO as contractor will be entitled to 45 percent of the production up to 275,000 barrels per day and 30 percent of any additional production. This "contractor type" agreement does not require any Iranian investment and provides that 50 percent of any recoverable reserves discovered be set aside as national reserve for NIOC use.

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The Mineral Industry of Iraq

By Agnes J. Doughman [1]

On March 1, 1969, the Kirkuk refinery and desulfurization plant of Iraq Petroleum Company (IPC) was hit by a series of explosions from external sources that caused extensive damage to installations and buildings. The explosions caused a drastic reduction in output for about 2 weeks until repairs were completed. Throughout the remainder of the year there were additional intermittent explosions and fires in various pipelines and installations.

Iraq issued, effective August 23, Law No. 41 of 1969 which set forth the responsibilities and administrative divisions of the Iraq Ministry of Oil and Minerals and canceled Law No. 4 of 1963. Pertinent sections of the new law are as follows:

1. The Minister, the highest authority in the Ministry, is responsible for its activities.
2. The Under Secretary assists the Minister in discharging the affairs of the Ministry according to powers delegated by the Minister.
3. The Ministry of Oil and Minerals shall be composed of the following departments:
   a. The Private Office. Shall be in charge of a Chief Superintendent reporting directly to the Minister. Shall be responsible for administering the confidential office.
   b. The Diwan (Administrative Department). Shall be directly attached to the Under Secretary and consist of the following departments: The Directorates of Administration and Personnel, Accounts, and Legal Department.
   c. The Directorate General of Oil Affairs. Administered by a Director General directly responsible to the Under Secretary. Shall be responsible for the administration and management of the Directorates of Company Affairs, Training and Vocational Preparation, Employment and Iraqization, and Department for the Supervision of Companies' Accounts.
   d. The Directorate General of Technical Affairs. Administered by a Director General responsible to the Under Secretary. Shall be responsible for the study of technical matters relating to oil and minerals.
   e. The Directorate General of Economic Affairs. Administered by a Director General reporting to the Under Secretary. Responsible for the study of economic matters relating to oil and its marketing. It shall consist of the following departments: The Directorates of Statistics and Research, Marketing, and Organizations and Conferences.

PRODUCTION

Iraqi crude oil production in 1969 continued at the same level as the previous year. However, marketed natural gas output reached 31,139 million cubic feet, an increase of 14 percent.

[1] Statistical assistant, Bureau of Mines, Washington, D.C.

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Table 1.—Iraq: Production of mineral commodities

Commodity		1967	1968	1969
NONMETALS				
Cement •	thousand metric tons	1,400	1,400	1,400
Gypsum •	do.	500	500	500
Salt	do.	41	• 40	• 40
MINERAL FUELS AND RELATED MATERIALS				
Gas, natural, marketed	million cubic feet	18,191	27,293	31,139
Petroleum:				
Crude	thousand 42-gallon barrels	r 448,239	r 549,110	553,999
Refinery products:				
Gasoline	do.	2,935	• 3,199	• 3,697
Kerosine and jet fuel	do.	4,554	• 4,962	• 6,383
Distillate fuel oils	do.	5,226	• 5,691	• 7,489
Residual fuel oils	do.	7,475	• 8,161	• 11,946
Liquefied petroleum gas	do.	• 60	• 60	• 158
Lubricants and other	do.	172	• 188	• 253
Asphalt and bitumen, refinery	do.	552	• 612	• 727
Total	do.	20,974	22,873	30,653
Refinery fuel and loss	do.	• 583	• 646	• 948

• Estimate. r Revised.

TRADE

Official Iraqi trade data are not available. However, data from the 24 industrial countries reporting to the United Nations indicate the magnitude of Iraqi import trade in major items as follows in metric tons unless otherwise specified:

Commodity		1967	1968
METALS			
Aluminum, metal, including alloys		592	1,149
Copper, metal, including alloys		499	1,553
Iron and steel, semimanufactures		87,043	108,957
Lead, metal, including alloys		154	116
Tin, metal, including alloys	long tons	39	NA
Zinc, metal, including alloys		NA	125
NONMETALS			
Asbestos, crude		549	231
Cement		3,264	10,237
Fertilizer materials, manufactured:			
Nitrogenous		4,436	490
Other		9,816	2,000
Sulfur, elemental		2,070	2,801
MINERAL FUELS AND RELATED MATERIALS			
Petroleum, refinery products:			
Distillate fuel oil	42-gallon barrels	13,749	72,011
Residual fuel oil	do.	55,584	381,045
Lubricants	do.	24,731	29,463
Other	do.	7,815	1,967

NA Not available.

In addition, in 1967 Iraq received 48,700 tons of iron and steel pipe and rolled products, and 700 tons of nonferrous rolled products from the U.S.S.R. The tonnage in 1968 for the same commodities was 89,600 tons and 1,000 tons, respectively.

Crude oil exports in 1967 were 424.1 million barrels and in 1968 increased to 524.8 million barrels. Of the known destinations, in 1967 France took 19 percent, Italy 14 percent, United Kingdom 5 percent, Spain 4 percent, and Belgium-Luxembourg, Turkey, and West Germany 3 percent each. In 1968, Italy took 24 percent, France 21 percent, Spain 5 percent, and the United Kingdom, Belgium-Luxembourg, and West Germany 4 percent each.

In 1969, crude oil exports reached 528.8 million barrels. The export shares of the three companies, IPC (the operating company), Basrah Petroleum Company (BPC), and Mosul Petroleum Company, remained at the same level as the previous year when they were 75 percent, 23 percent, and 2 percent, respectively.

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COMMODITY REVIEW

NONMETALS

Fertilizer Materials.—Construction continued on the chemical fertilizer plant at Abu al-Khusaib, near Basrah, with completion scheduled for June 1970. Feedstock will be natural gas from the Rumaila field and sulfur from the Kirkuk sulfur recovery plant. The fertilizer plant is expected to supply the domestic demand for nitrogen fertilizer as the market increases under Government agrarian reform. At the present time Iraq consumes about 7,000 tons of nitrogen annually. It is doubtful whether all the plant's output will be absorbed by the domestic market for some years. The Mitsubishi group is the contractor for the plant, which is expected to cost about $19 million.[2]

Sulfur.—It was reported that a Soviet mineral survey team has located 11 sulfur deposits. Some are remotely located while others are near Mosul and Ramadi. The Mishraq deposit near Mosul contains an estimated reserve of 100 million tons. The Polish firm Centrozap under contract to the Iraq National Minerals Company (INMC) completed a survey of the Mishraq deposit, and active field operations were to start in early 1970. Initial annual production of 250,000 to 350,000 tons scheduled for 1972 is expected to increase to a minimum of 1 million tons. A Polish system similar to the Frasch process is to be used for the sulfur extraction. The INMC is to pay Centrozap $3.5 million as a patent fee. The Iraq Ports Administration and INMC were preparing special port facilities at Umm Qasr to export the sulfur.

Sulfur recovered from associated gas at the Kirkuk plant of IPC was offered for sale, with the first bids invited by October 4, 1969, for 20,000 tons to be available within 1 year. With the exception of Iraqi Government companies, all other bidders were to include a cash deposit or a bank guarantee of $14,000 valid for at least 6 months. It is expected that 100,000 tons annually will eventually be available to the export market.

MINERAL FUELS

Natural Gas.—It was reported that a feasibility study was completed on the projected natural gas pipeline from Iraq to Turkey. It would include main trunk and branch lines of 24- to 30-inch pipe and 8- to 24-inch pipe from distribution facilities to consumption areas. The line would supply 9.5 million cubic meters of gas in the first year and would double the amount after 10 years. It was estimated that gas would reach Istanbul 30 months after the pipeline is started. Financial arrangements for the project were not reported.

Petroleum.—An agreement was concluded between the Iraq Ports Administration and BPC regarding the port dues on crude oil shipments from Iraqi ports. The following agreement was signed June 30 and ratified under Law No. 117 of 1969, published in the Iraqi official gazette, issue No. 1759, dated July 27, 1969:

1. (a) Financial Year means Government Financial Year from April 1 to March 31.
   (b) The Effective Date means the date agreed upon between the Ports and the Company as the date upon which this agreement will come into force.
2. (a) The Company shall pay to the Ports in respect of the Financial Year in which Effective Date occurs, and each subsequent Financial Year, the Port (Traffic) Dues on cargo shipped into seagoing vessels in respect of the crude oil produced by the Company and loaded at an Iraqi Port in accordance with the following scale (One Iraqi Dinar (1,000 fils) equals U. S. $2.80):
   On the first 8 million long tons—280 fils per ton.
   On the next 2 million long tons—140 fils per ton.
   On the next 2 million long tons—70 fils per ton.
   On the next 4 million long tons—35 fils per ton.
   On all additional tonnages—26 fils per ton.
   (b) The scale of dues specified in paragraph (a) shall not be changed except by agreement between the Ports and the Company.
   (c) No other impositions of any sort shall be charged or levied by the Ports on or in respect of oil exported by the Company through the Deep Water Terminal at Khor Al-Amaya.
3. If payments made by the Company to the Ports in respect of any Financial Year pursuant to paragraph (a) of Article 2 fall short of ID2,800,000 then, unless shortfall is the result of force majeure, the Company shall pay to the Ports an amount equal to such shortfall.
4. Dues and charges for services rendered to vessels loading the Company's oil will be non-discriminatory and designed to enable the Ports to recover reasonable costs.

[2] Where necessary, values have been converted from Iraq Dinars (ID) to U.S. dollars at the rate of ID = US$2.80.

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5. The Company shall within 10 days of the Effective Date pay to the Ports the sum of ID3,216,353 in full and final settlement of all claims against the Company in respect to Port (Traffic) Dues which relate to any period up to the end of the Financial Year 1968/1969.
6. Any disagreements which may arise regarding the interpretation or execution of the agreement which the parties fail to agree upon shall be referred to two arbitrators and a referee.
7. This agreement shall remain in force unless amended by mutual agreement.

The Iraqi Government moved to block all claims of IPC and its associates to the North Rumaila oilfield and other concessions by canceling Article 3 of the 1961 Law 80, which expropriated all the group's acreage except actual producing areas totaling about 740 square miles. Article 3 permitted the Government to allocate to IPC additional acreage if deemed suitable.

In midyear the Iraqi Government completed arrangements to develop the proven reserves and to further explore the area taken from the IPC. Under a short-term agreement signed in June 1969, the Soviet firm Machinoexport was to supply equipment and technical assistance to aid the Iraq National Oil Company (INOC) in developing the Al-Halfayah region about 80 miles northwest of Basrah and other areas assigned to INOC where oil reserves have been established. Cost of the development was estimated to be about $72 million, 25 percent to be paid on delivery and partly by letter of credit and 75 percent to be paid in equal installments at 3-percent interest over a 5-year period. In July an economic and technical agreement was signed by the Soviets to supply a $70 million loan for development of the North Rumaila and Ratawi oilfields. This loan was to be repaid in crude oil. The first stage of development of The North Rumaila area would provide for exports of 5 million tons annually and would involve the construction of an 80-mile pipeline to Fao on the Persian Gulf.

In October 1969 it was announced that the Hungarian firm Kemokomplex signed a contract to drill four wells for INOC in the North Rumaila oilfield. The Hungarian organization will extend a $15 million loan to INOC for equipment and technical assistance in the exploitation of Iraqi oil resources. Interest on the loan will be 3 percent annually. INOC will repay the loan at the rate of 10 percent of the value of each contract within 1 month of signature, an additional 15 percent of value of each contract upon shipment, and the remainder in 14 installments over a 7-year period. Hungarian authorities expressed a willingness to purchase INOC crude oil if and when appropriate transportation facilities between the Mediterranean and Hungary are completed.

In December 1969 a protocol was signed by Government officials of Iraq and Czechoslovakia for construction of a 70,000-barrel-per-day refinery at Abu Fulus near Basrah by the Czechoslovakian firm Technoexport. Specifications for the refinery were drawn up by a U.S firm in 1967–68 with construction costs an estimated $50 million. The refinery was designed to meet the future demand for petroleum products in Southern Iraq and was expected to have an export surplus, particularly fuel oil during its early years of operation. Construction payments were to be made through a wide-ranging barter deal.

A 30,000-barrel-per-day refinery at Mosul and several petrochemical projects are planned, but details were not reported.

Bids were prepared for construction of a 1-million-barrel-per-day pipeline to carry North Rumaila crude oil to the Syrian port of Tartous on the Mediterranean. The INOC wants a 48-inch, 775-mile line with six pumping stations, storage for 8.6 million barrels, and port facilities. Prospective bidders are to make the financial arrangments and will be repaid in crude oil over a period of years. Cost of the project will be from $400 million to $450 million.

INOC has signed long-term agreements to dispose of North Rumaila crude oil when production begins. Countries slated to receive the crude oil are the Soviet Union, Czechoslovakia, Hungary, East Germany, Ceylon, and Spain.

At yearend it was announced that the French oil company Entreprise de Recherches et d'Activités Pétrolières (ERAP) had encountered oil with its exploratory well Buzurgan No. 1 in the Tayib region in Amara Province. The well is located in Block 1 of acreage contracted to ERAP by INOC in February 1968.

Iraq's proved crude oil reserves at the end of 1968 were an estimated 28.5 billion barrels, ranking fifth among the seven countries that hold 70 percent of the world's crude reserves.

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The Mineral Industry of Ireland

By F. L. Klinger [1]

Ireland's mining industry continued to grow in 1969. Output and exports of zinc concentrates were sharply increased, and construction of a zinc smelter appeared to be imminent. Production of mercury was started, and new plants for production of zinc oxide and magnesia were under construction. A substantial increase in output of mine copper was expected by 1971. Stimulated by a favorable investment climate and the important mineral discoveries of the past decade, exploration activities extended into most Irish counties and by early 1969, some 1,600 prospecting licenses had been granted to Irish and foreign companies. Offshore drilling for oil and gas was expected to start in 1970.

There was increased production, trade, and consumption of most mineral commodities in 1969. As compared with 1968, production gains of 8 to 13 percent were reported in the mining, metals and engineering, and construction industries, while consumption of electric power was up 15 percent. The high level of internal demand taxed the production capacity for some important commodities and led to significant increases in imports. Labor productivity, however, was adversely affected by work stoppages and there was an 11-percent gain in the average industrial wage.

PRODUCTION

Volume of production in the mining and quarrying industry in the first 11 months of 1969 was 11 percent higher than in the comparable period of 1968. Gains in output of lead and zinc ores, barite, construction materials, and peat were the main contributing factors. Production of cement was 6 percent less than in 1968 but this appeared to be a reflection of production capacity rather than an indication of slackened demand. Output of coal continued to decline.

[1] Physical scientist, Bureau of Mines, Washington, D.C.

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Table 1.—Ireland: Production of mineral commodities [1]

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969 [p]
METALS			
Copper, mine output, metal content	4	7	6
Lead, mine output, metal content	60	62	e 65
Mercury, 76-pound flasks	-----	-----	420
Silver, mine output, metal content, thousand troy ounces	2,067	1,913	e 2,000
Steel ingots and castings	65	68	e 75
Zinc, mine output, metal content	30	53	e 105
NONMETALS			
Barite	76	143	161
Cement	1,298	1,352	1,273
Fertilizer, manufactured (P_2O_5 content of superphosphate)	83	95	NA
Gypsum	252	NA	NA
Lime	42	63	52
Limestone [2]	4,820	5,064	5,387
Sand and gravel [2]	2,649	3,717	4,352
Other [3]	2,431	2,720	3,201
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite	111	103	90
Semibituminous	71	63	63
Coke, gashouse	93	e 82	e 50
Gas, manufactured [4], million cubic feet	6,568	6,533	e 6,900
Peat:			
Agricultural use	37	41	54
Fuel use:			
Briquets	309	250	314
Sod peat [5]	2,230	2,248	2,188
Milled peat [6]	r 2,049	r 2,521	3,927
Petroleum refinery products:			
Gasoline and naphtha, thousand 42-gallon barrels	4,012	4,459	4,777
Aviation fuel, do	199	685	616
Distillate fuel oil, do	5,916	4,662	4,692
Residual fuel oil, do	7,173	6,181	6,307
Other, do	952	413	475
Refinery fuel and loss, do	634	713	NA

e Estimate. p Preliminary. NA Not available. r Revised.

[1] According to information available in August, 1970.

[2] Figures do not include stone, sand and gravel, and other materials for maintenance of roads.

[3] Includes granite, marble, silica rock, sand, calcspar, fire clays, and shale and clay for cement.

[4] Converted from cubic meters of 4,200 kilocalories, using 35.3144 cubic feet equals 1 cubic meter.

[5] Including production by farmers and Bord na Móna.

[6] Production of Bord na Móna.

TRADE

Incomplete data indicated that exports of metal ores and concentrates rose sharply in 1969. The value of exports in the first 9 months was $32 million, compared with $17 million in the same period of 1968. Zinc concentrates accounted for most of the increase, in tonnage as well as in value. Exports of barite, petroleum products, and manufactured fertilizers also increased, while there was a decline in exports of nonmetallic mineral manufactures, especially cement.

In the same 9 months, imports of all major categories of mineral commodities increased, except for nitrogenous and potassic fertilizer materials. The largest increases were indicated in iron and steel and petroleum products.

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Table 2.—Ireland: Exports [1] of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum metal, including alloys:		
Scrap	670	624
Unwrought and semimanufactures	5,444	4,151
Copper metal, including alloys:		
Scrap	3,993	4,095
Unwrought and semimanufactures	1,086	1,902
Iron and steel:		
Scrap	32,039	26,953
Steel, primary forms	542	226
Semimanufactures	12,177	17,434
Lead:		
Ore and concentrate	135,577	156,437
Metal, including alloys:		
Scrap	407	NA
Unwrought and semimanufactures	606	1,529
Zinc ore and concentrate	34,449	85,448
Other ore and concentrate	453	NA
NONMETALS		
Barite and witherite	74,765	142,252
Cement, thousand tons	358	292
Clay and clay products:		
Refractory (including nonclay bricks)	40,295	38,188
Nonrefractory	14,002	NA
Fertilizer materials:		
Manufactured	1,416	244
Gypsum and plasters, thousand tons	113	130
Stone, sand and gravel:		
Gravel and crushed rock, do	307	326
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets:		
Anthracite and bituminous coal	6,746	7,516
Coke and semicoke	23,401	14,528
Peat, including peat briquets	60,749	62,516
Petroleum refinery products:		
Gasoline, thousand 42-gallon barrels	366	76
Distillate fuel oil, do	2,384	820
Residual fuel oil, do	2,212	1,444

NA Not available.
[1] Excludes reexports.

Table 3.—Ireland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum metal, including alloys:		
Unwrought	8,360	8,428
Semimanufactures	4,777	5,758
Copper metal, including alloys:		
Unwrought	148	183
Semimanufactures	6,353	8,396
Iron and steel:		
Pig iron, ferroalloys, and similar materials	28,592	22,977
Semimanufactures:		
Bars, rods, angles, shapes, and sections:		
Wire rod	18,270	23,994
Other bars and rods	13,857	24,163
Angles, shapes, and sections	23,155	38,623
Universals, plates and sheets	64,771	78,875
Hoop and strip	6,264	7,437
Rails and accessories	4,693	4,979
Wire	4,718	6,580
Tubes, pipes and fittings	31,557	37,848
Castings and forgings, rough	116	NA
Lead:		
Oxides	1,449	NA
Metal, including alloys, all forms	421	1,148
Nickel metal, including alloys, all forms	303	449
Platinum-group metals and silver metal, including alloys:		
Platinum group, value, thousands	$20	$147
Silver, all forms, do	$294	$373
Tin metal, including alloys, all forms, long tons	93	33
Titanium oxide	2,451	2,639

See footnotes at end of table.

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Table 3.—Ireland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS—Continued			
Zinc:			
Oxides		477	NA
Metal, including alloys:			
Unwrought		3,661	4,504
Semimanufactures		260	668
Other, ore and concentrate		14,160	18,464
NONMETALS			
Asbestos		4,751	4,018
Cement	thousand tons	9	213
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.		30,686	35,912
Products:			
Refractory (including nonclay bricks)		10,679	11,630
Nonrefractory		5,094	6,326
Fertilizer materials:			
Crude:			
Nitrogenous	thousand tons	1	1
Phosphatic	do.	358	425
Manufactured:			
Nitrogenous	do.	36	46
Phosphatic:			
Thomas slag	do.	117	153
Other	do.	12	
Potassic	do.	198	233
Other, including mixed	do.	84	115
Ammonia		15,540	31,990
Lime		4,126	NA
Pyrite (gross weight)		1,930	1,102
Salt	thousand tons	47	50
Sodium and potassium compounds, n.e.s., caustic soda		4,665	5,164
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked		3,010	3,131
Worked		396	393
Gravel and crushed rock		9,770	NA
Sand, excluding metal bearing		31,925	38,576
Sulfur:			
Elemental		99,422	104,140
Sulfuric acid, including oleum		1,577	28,936
Other nonmetals, n.e.s.		9,645	12,664
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		589	3,163
Coal and briquets:			
Anthracite and bituminous	thousand tons	1,258	1,221
Briquets of anthracite and bituminous coal	do.	3	2
Coke and semicoke	do.	17	22
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	18,785	17,128
Refinery products: [1]			
Gasoline	do.	544	493
Jet fuel	do.	1,288	1,240
Kerosine, white spirit, and special boiling point liquids	do.	581	690
Distillate fuel oil	do.	343	477
Residual fuel oil	do.	5,301	5,301
Liquefied petroleum gases	do.	116	220
Lubricants •	do.	245	266
Bitumen	do.	73	412
Petroleum coke	do.	456	-------
Other •	do.	310	1,360

• Estimate. NA Not available.
[1] Source: OECD (Paris). Oil Statistics, Supply and Disposal. 1967 and 1968.

COMMODITY REVIEW

METALS

Copper, Lead, Zinc, Silver, and Mercury.—A full year's production from the Silvermines property of Mogul of Ireland, Ltd., accounted for the heavy increase in output of mine zinc in 1969 and was also responsible for maintaining the national output of mine lead at approximately the level of 1968. Production of concentrate at the Tynagh mine of Irish Base Metals, Ltd., was about 30 percent lower than expected, mainly because of a strike which idled the plant from July until October. Approxi-

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mate shares (in percent) of the three producing mines in total mine output of nonferrour metals in 1969 were estimated as follows:

	Tynagh	Gortdrum	Silvermines
Copper	30	70	--
Lead	75	--	25
Zinc	20	--	80
Silver	70	15	15
Mercury	--	100	--

At Tynagh, metallurgical tests in 1969 indicated the feasibility of producing zinc oxide concentrate by flotation from zinc oxide ore and of calcining the concentrate to obtain a marketable product. By yearend, a calcining plant was under construction, with completion scheduled for August 1970. It was planned to treat 92,000 tons of this ore in 1970, compared with 17,000 tons in 1969, with recovery of 60 to 70 percent of the zinc. Zinc oxide ore, averaging 20 percent zinc, 1.7 percent lead, and 0.8 ounce silver per ton, was the principal component of open pit reserves at Tynagh; it accounted for 513,000 tons or 21 percent of the total at yearend 1969.

Production of mercury was started in 1969 by Gortdrum Mines (Ireland) Ltd. in County Tipperary. The mercury extraction plant, completed in July at an estimated cost of $1.2 million, processed 2,669 tons of concentrate by yearend. The plant was reported to have a processing capacity of 75 tons of concentrate daily. Mercury content of the concentrate ranges between 0.5 and 1.0 percent; the anticipated recovery of metal was 75 to 90 percent. Minimum mercury content of the Gortdrum ore body was estimated at 12,000 flasks. The mercury occurs as cinnabar and is also associated with tetrahedrite; its distribution in the orebody was described as erratic. Gortdrum ore reserves at yearend 1968 were reported to be 3,430,000 tons, averaging 1.33 percent copper and 1.2 ounces of silver per ton.

The first full year of production at Silvermines yielded 36,000 tons of lead concentrates and 175,000 tons of zinc concentrates in 1969, about three times the quantity produced in 1968. Mill heads averaged 2.42 percent lead and 10.22 percent zinc. Ore reserves in "G" and "B" ore bodies totaled 12.5 million tons, averaging 2.95 percent lead, 6.72 percent zinc, and 0.85 ounce silver per ton. The output of this mine was responsible for the three-fold increase in Irish exports of zinc concentrate that occurred in 1969.

Preparations to re-open the Avoca copper-pyrite mine were continued. Underground mining, at the rate of 2,000 tons of ore daily, was expected to commence by the end of 1970. Patiño Mining Corp., which has a 10-percent interest in the venture, reported that ore reserves were estimated at 7 million tons averaging 0.98 percent copper after dilution. The mine was last worked in 1962.

In County Limerick, exploration drilling of the Aherlow copper-silver prospect south of Tipperary was continued by Irish Metal Mining Co. Ltd. Results indicated that a major thrust fault may be present, and further drilling was planned. At yearend 1968, exploration had suggested the presence of 6 million tons of mineralized ground, including a possible 3 million tons averaging 1.2 percent copper and 1.6 ounces silver per ton. International Mogul Mines Ltd. owned a 40-percent share of the exploration company.

Studies of the feasibility of building a smelter for lead and/or zinc in Ireland were continued by Smelter Corporation of Ireland, Ltd., but no definite plans were reported by yearend. Questions to be decided were whether to build an Imperial Smelting Furnace or an electrolytic zinc plant, and whether to site the plant on the Shannon estuary, close to the principal mines, or on Little Island in County Cork. Annual metal production of 60,000 tons was being considered. Principal shareholders in the smelter company were Northgate Exploration Ltd. (51 percent) and Tara Exploration and Development Co. Ltd. (30 percent).

Iron and Steel.—Ireland continued to import most of its steel requirements. Imports of semimanufactures in the first 11 months of 1969 were running about 20 percent more than in the corresponding period of 1968. Domestic consumption was estimated at about 300,000 tons of ingot equivalent.

Crude steel was produced by Irish Steel Holdings, Ltd., from scrap and imported pig iron. The plant, on Haulbowline Island in Cork Harbor, was equipped with a single 75-ton open-hearth furnace and rolling mills for sections, bars, and rods. Annual production capacity was approximately 75,000 tons of crude steel, 60,000 to 70,000 tons of rolled products, and

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25,000 tons of galvanized sheet. Sheet for galvanizing and part of the rolling mill output are based on imported semimanufactures.

NONMETALS

Barite.—Production and exports of barite continued to rise. Exports in the first 10 months of 1969 were running 12 percent above the comparable period of 1968. Most of the shipments were destined for the United States.

Magcobar (Ireland) Ltd., a subsidiary of Dresser Industries, Inc., remained the major producer. The company's mine at Ballynoe, which is adjacent to the Silvermines property of Mogul of Ireland, Ltd., in County Tipperary, is estimated to have produced more than 500,000 tons of barite since production began in December 1963. Minimum reserves of barite at yearend 1969 were believed to be 2.5 million tons. The barite is exported from the port of Foynes, on the Shannon estuary, about 45 miles west of the mine.

At Tynagh, feasibility studies for production and marketing of byproduct barite were presumably continued in 1969. A pilot plant, for recovering the barite from tailings, began operating in November 1968.

Cement.—Output of cement apparently remained close to productive capacity, although reported production was less than in 1968. Trade in cement was sharply reduced, with both exports and imports 65 percent less than the levels of the previous year. On the other hand, domestic sales in the second and third quarters were 10 to 14 percent greater than in the corresponding periods of 1968. Domestic consumption was approximately 1.2 million tons. Although demand appeared to be rising, no increase in productive capacity was reported to be under construction or planned. Two three-kiln plants, operated at Drogheda and Limerick by Cement Ltd., apparently have accounted for all Irish production since 1965.

Magnesia.—Construction of a magnesia plant at Dungarvan, County Waterford, and a dolomite processing plant at Bennettsbridge, County Kilkenny, was continued in 1969 by the Quigley Co., Inc., a subsidiary of the Pfizer group. Both plants were expected to begin production by mid-1970. The Dungarvan plant will reportedly be capable of producing 75,000 tons of magnesia per year from sea water and dolomite. Magnesia is a basic raw material used in the Quigley spray-mix process for extending the life of refractory linings in steelmaking vessels, particularly the basic oxygen furnace.

MINERAL FUELS

Estimated consumption of energy in Ireland in 1969 was approximately 8.3 million tons of standard coal equivalent. About two-thirds of the supply came from imported fuels, while domestic resources, principally peat, provided the remainder. Approximate shares of the contributing fuels were: petroleum (50 percent); imported coal (15 percent); peat (28 percent); hydropower (5 percent); and domestic coal (2 percent). The use of petroleum fuels continued to grow at a rapid rate.

Coal, Coke, and Peat.—The heavy increase in output of peat in 1969, according to Bord na Móna, was due partly to the best weather conditions in 8 years and partly to the lack of work stoppages as compared with 1968. Also, increases in the price of imported coal improved the competitive position of peat on the domestic market.

Output of peat for electric power generation increased by more than 50 percent, to 2.5 million tons. Peat was burned in 11 powerplants, which accounted for one-third of all thermoelectric power generated in 1968. Increased demand for peat was also reflected in the output of peat briquettes, which rose to 90 percent of production capacity, and a 38-percent increase in exports of peat for agricultural use.

Imports of coal and coke in the first 10 months of 1969 were almost identical with the totals for the corresponding period of 1968. Imports of gas coal, mostly obtained from Poland, declined by 60 percent but imports of other grades of coal were increased.

Petroleum. — *Exploration.* — Reconnaissance seismic surveys of three offshore blocks totaling 17,500 square miles were completed in 1969 by Marathon Petroleum Ireland Ltd. The surveys covered a large part of the area off the south coast (block 1), and areas west of County Clare (block 2) and Counties Mayo, Sligo, and Donegal (block 3). In an agreement with

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the Government in early 1969, the company received exclusive rights to explore in these areas and agreed to spend at least $500,000 on exploration. Drilling was expected to begin in 1970.

No activity was reported onshore. Since 1961, five onshore holes—one each in Counties Meath, Clare, Leitrim, Cavan, and Cork—have been drilled, with negative results.

Crude oil and petroleum products.—Imports of crude and partly refined petroleum increased less than 2 percent compared with those in 1968. Iran and Saudi Arabia were the principal suppliers, as deliveries from Iraq and Libya were sharply reduced.

Imports of refined products apparently increased more than 30 percent as domestic consumption continued to climb. Residual fuel oil was principally responsible for the growth of imports and consumption, as well as a 10-percent reduction of exports in 1969. Inland consumption of petroleum products is shown in the following table, in thousand metric tons:

Product	1968	1969
Gasolines	526	576
Aviation fuels [1]	54	99
Kerosine	77	70
Gas/diesel oil	528	664
Residual fuel oil	1,247	1,624
Other	227	147
Total	2,659	3,180

[1] Excludes bunkering of foreign aircraft.

Source: OECD (Paris). Provisional Oil Statistics by Quarters (4th Quarter 1969). 1970.

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The Mineral Industry of Israel

By Walter C. Woodmansee [1]

Most sectors of the Israeli mineral industry showed improvement in 1969 as the economy continued to expand and the gross national product (GNP) reached $4.7 billion [2 3] ($4.0 billion in 1968). The most significant developments were in the petroleum sector where exploration has moved offshore. The county's second petroleum refinery was approved and construction commenced, and a major new transit pipeline connecting the Gulf of Aqaba and the Mediterranean Sea was essentially completed. A magnesia plant was planned, using magnesium chloride from the Dead Sea Works Ltd. (DSW), and several new projects were planned or underway in the chemical and fertilizer sectors.

The Oceanographic and Limnological Research Co. Ltd., an agency of the National Council of Research and Development, working with the Geological Survey of Israel and the Israel Port Authority, completed a hydrographic, geologic, and oceanographic survey to 100 kilometers offshore from the Lebanon border to Port Said. This survey was primarily for petroleum and construction sand. Maps of the surveyed area will probably be published in 1970. An Institute of Oceanography and Limnology will be founded at Tel Shikmona, a Haifa suburb. Construction was scheduled to start in late 1969.[4]

PRODUCTION

Production statistics on several mineral commodities were not reported for 1969 and were estimated. Several major mineral commodities—copper, bromine, cement, phosphate rock, and petroleum refinery products—showed notable increases in output. Modest crude oil production continued to gradually decline, but output from Israeli-occupied Sinai Peninsula, although not officially reported, appears to have increased substantially. Products by type at the Haifa oil refinery were estimated as percentages of total refinery yield.

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[1] Physical Scientist, Bureau of Mines, Washington, D.C.

[2] U.S. Embassy, Tel Aviv. State Department A–90, Apr. 3, 1970, p. 2.

[3] Where necessary, values have been converted from Israeli pounds (IL) to U.S. dollars at a rate of IL 3.5 = US $1.00.

[4] U.S. Embassy, Tel Aviv. State Department A–418, July 5, 1969, 2 pp.

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Table 1.—Israel: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969
METALS			
Copper, cement, 70 to 80 percent Cu, gross weight....metric tons	9,464	10,282	10,683
Iron and steel: Steel, ingots e	84	r 100	120
NONMETALS			
Bromine:			
Elemental....metric tons	6,320	9,376	10,550
Compounds....do	1,858		
Cement, hydraulic	805	e 1,200	e 1,300
Clays, marketed	111	8	15
Fertilizer materials:			
Crude:			
Phosphate, beneficiated	e 600	777	987
Potash:			
Gross weight	492	e 600	548
Potassium oxide (K_2O) equivalent	300	e 366	334
Manufactured:			
Nitrogenous e	95	95	100
Phosphatic	132	154	e 160
Potassic	1	2	e 2
Gypsum	e 90	e 70	71
Lime e	80	80	130
Quartz, sand, marketed	35	47	e 45
Salt, mainly marine, marketed	57	65	e 57
Sulfur	2	6	e 8
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural....million cubic feet	3,859	5,015	4,873
Peat e	20	20	20
Petroleum:			
Crude [2]....thousand 42-gallon barrels	971	831	719
Refinery products:			
Gasoline....do	4,850	e 5,848	e 6,279
Kerosine and jet fuel....do	4,958	e 5,085	e 5,460
Distillate fuel oil....do	8,479	e 7,701	e 8,268
Residual fuel oil....do	13,150	e 11,987	e 12,870
Other....do	r 2,515	e 2,978	e 3,588
Total....do	33,952	e 33,599	e 36,465

e Estimate. r Revised.

[1] In addition to commodities listed, Israel also produces construction materials, such as dimension stone, crushed rock, sand and gravel, but output data are not available.

[2] Does not include Israeli production from occupied Sinai Peninsula oilfields.

TRADE

Israel's principal exported mineral commodities and their sales values during 1968 (the last year for which complete data are available) were as follow: Diamond (gross sales) $229.3 million ($193 million in 1967), potash $13.5 million ($13.6 million in 1967), cement copper $11.6 million ($10.4 million in 1967), and beneficiated phosphate $6.9 million ($4.7 million in 1967).

Gross diamond sales alone contributed nearly 36 percent to the total export value of $640 million in 1968 and were expected to increase further in 1969. Net sales were $194.8 million. At yearend 1968 there were 230 diamond exporters and 442 enterprises working diamond. Imports of rough diamond totaled $180.6 million in 1968 and $195 million in 1969. Stocks on hand were in excess of needs and apparently remained large in case of a devaluation of the Israeli pound.

Exports of both phosphate and potash showed substantial increases in quantities shipped, but earnings from potash were reduced because of depressed prices prevailing during 1968.

In the petroleum sector, complete data on exports and imports of crude oil and refinery products were not reported, and statistics are estimated. Exports of products from the Haifa refinery were valued at $17.9 million in 1968, and imports of crude oil and refinery products totaled $60.6 million.[5] Imports of residual fuel oil continued high for use in electricity generation.

[5] Petroleum Press Service. V. 36, No. 8, August 1969, p. 313.

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Table 2.—Israel: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, all forms	1,855	2,891
Copper:		
Concentrate (cement copper)	13,636	15,096
Metal, including alloys, all forms	3,536	3,066
Iron and steel: Metal:		
Scrap	1,465	2,001
Steel, primary forms	20	---
Semimanufactures	8,664	9,577
Lead, metal, including alloys, all forms	347	312
Nickel, metal, including alloys, all forms	11	33
Zinc, metal, including alloys, all forms	313	109
NONMETALS		
Bromine and products	5,718	3,683
Cement and clinker	251,536	174,394
Clay and clay products:		
Crude clays	2,230	6,215
Products, refractory	2,821	3,860
Diamond, gem, not set or strung—thousand carats	1,449	1,701
Fertilizer materials:		
Crude:		
Phosphate	419,998	647,340
Potash (61 percent K_2O)	454,631	558,434
Other	---	1,808
Manufactured:		
Nitrogenous	504	---
Phosphatic	1,420	13,863
Gypsum	200	27,686
Precious and semiprecious stone, except diamond—value thousands	$351	$415
Salt	285	335
Sodium and potassium compounds, caustic soda	495	1,504
Sulfur, elemental, all forms	315	944
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	2,603	335
Carbon and carbon black	7,154	8,076
Petroleum:		
Crude and partly refined •—thousand 42-gallon barrels	7,700	11,779
Refinery products: •		
Gasoline—do	1,800	2,225
Kerosine—do	850	1,875
Jet fuel—do	675	
Distillate fuel oil—do	3,350	1,200
Residual fuel oil—do	2,800	---
Other—do	1,010	130
Total—do	10,485	5,430

• Estimate.

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Major destinations of selected commodities, 1968

(Metric tons unless otherwise specified)

Commodity	Quantity
Copper, concentrate (cement copper), total	15,096
Germany, West	2,113
Greece	1,972
Hungary	3,067
Spain	4,725
Yugoslavia	2,715
Other	504
Diamond, worked, total thousand carats	1,701
Belgium-Luxembourg do	185
Hong Kong do	196
Japan do	186
Netherlands do	124
Switzerland do	126
United States do	681
Other do	253
Phosphate rock, beneficiated, total	647,340
Hungary	51,045
Italy	105,712
Netherlands	52,467
Rumania	147,926
Spain	29,420
United Kingdom	42,790
Yugoslavia	98,326
Other	119,654
Potash, total	558,484
Belgium-Luxembourg	40,494
Brazil	70,325
France	74,179
Germany, West	22,500
Hungary	27,498
Japan	79,677
Malaysia	24,845
United Kingdom	58,519
United States	60,216
Other	100,181

Table 3.—Israel: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite	717	799
Oxide and hydroxide	697	585
Metal, including alloys, all forms	r 7,672	14,149
Cadmium, metal, including alloys, all forms	3	---
Copper, metal, including alloys, all forms	7,015	12,498
Gold, metal, unworked or partly worked troy ounces	198,884	7,716
Iron and steel: Metal:		
Pig iron, ferroalloys, and similar materials	4,771	18,110
Steel, primary forms	35,906	185
Semimanufactures	197,450	559,757
Lead:		
Oxides	615	745
Metal, including alloys, all forms	1,607	2,618
Magnesium, metal, including alloys, semimanufactures	48	17,164
Manganese, oxides	190	475
Mercury 76-pound flasks	208	NA
Nickel, metal, including alloys, all forms	122	1,167
Platinum group metals, including alloys, all forms troy ounces	30,768	579
Silver, metal, including alloys do	442,910	591,220
Tin, metal, including alloys, all forms long tons	182	208
Titanium, oxides	1,314	2,176
Zinc:		
Oxide	431	532
Metal, including alloys, all forms	4,170	4,404
Other:		
Ores and slag	744	768
Base metals, including alloys, all forms, n.e.s.	68	100
NONMETALS		
Abrasives, n.e.s.:		
Natural	112	128
Corundum, artificial	183	299
Asbestos	4,269	8,352
Barite	1,007	762
Bromine and iodine	12	15
Cement	8,343	11,197

See footnotes at end of table.

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Table 3.—Israel: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968
NONMETALS—Continued		
Clays and clay products (including refractory brick):		
Crude clay, kyanite, andalusite, etc	21,522	28,657
Products:		
Refractory	1,558	1,743
Nonrefractory, flags, setts, etc.....thousand square meters	47	117
Cryolite and chiolite	106	---
Diamond:		
Gem, not set or strung.....thousand carats	3,090	3,873
Industrial, including bort.....do	1,353	1,223
Diatomite	355	549
Feldspar	1,650	2,268
Fertilizer materials: Manufactured:		
Nitrogenous, including urea	9,138	8,546
Other	226	611
Fluorspar	524	666
Graphite, natural	44	---
Gypsum and plasters	173	---
Magnesite	1,136	1,629
Mica, crude, including splitting and waste	68	135
Pigments, mineral, processed iron oxides	236	409
Salt (excluding brines)	1,156	---
Sodium and potassium compound, n.e.s	645	1,069
Stone, sand and gravel:		
Dimension stone, crude and partly worked:		
Calcareous	136	80
Other	72	---
Crushed rock	985	2,672
Quartz and quartzite	772	1,040
Sulfur:		
Elemental, all forms	73,428	70,056
Sulfuric acid	42,307	35,616
Talc and steatite	1,452	2,253
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	66	---
Bituminous mixtures	197	207
Carbon black	714	1,624
Coal, all grades, including briquets	266	3,524
Coke and semicoke	6,305	6,023
Peat	303	362
Coal products	441	579
Petroleum:		
Crude and partly refined •.....thousand 42-gallon barrels	[1] 36,350	[1] 50,700
Refinery products: •		
Aviation gasoline.....do	151	112
Residual fuel oil.....do	725	2,664
Lubricants.....do	132	160
Other.....do	6	---
Total.....do	1,014	2,936

• Estimate. r Revised. NA Not available.

[1] Includes estimated receipts from Israeli-occupied Sinai Peninsula oilfields.

COMMODITY REVIEW

METALS

Copper.—Timna Copper Co. produced 1,081,340 tons of ore containing 1.14 percent copper during 1969. This output was valued at $16.3 million. The new $4.9 million Timna No. 2 shaft was completed as part of a development project on an adjacent ore body, which reportedly assures Timna operations for 20 years.

Magnesium.—The Government-owned Israel Chemicals Ltd. planned to establish a 46,000-ton-per-year magnesia plant at Arad in 1970, using byproduct magnesium chloride from DSW. Financial and technical assistance will be provided by Osterreichisch-Amerikanische Magnesit A. G. (OEAMAG), a major supplier of dead-burned magnesite and basic refractories, and controlled by the Great Lakes Carbon Corp.[6]

NONMETALS

Fertilizer Materials.—American Israel Phosphate Corp. (AIPC) planned a $14.3 million investment in a phosphate mining and beneficiation project at Ein Yahav in the Negev. The annual output rate will be

[6] Industrial Minerals, London. No. 27, December 1969, p. 28.

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600,000 tons at 32 percent P_2O_5 and 250,000 tons at 35 percent P_2O_5.[7] AIPC which has held a mining lease on the property for several years, signed a contract with the Israeli Government. The company has 1 year, starting March 31, 1970, to complete designs and technical details and then 1½ years for construction. Singmaster and Breyer, Inc. (a United States engineering firm) is consultant on the mining plan and the transport and shipping facilities. Phosphate will be exported from the port at Eilat.

The $40 million, 165,000-ton-per-year phosphoric acid plant of Arad Chemical Industries Ltd. was essentially completed during 1969 and was expected to be fully operational in early 1970. The company also considered a joint venture with Madera Corp., United States, for producing a range of phosphatic fertilizers and chemicals, primarily for export.

Output of phosphate beneficiated to 26 to 34 percent P_2O_5, essentially all by Chemicals and Phosphates Ltd. (C&P), increased by 27 percent in 1969. The expansion program underway included construction of a terminal in Rotterdam for handling phosphate for markets in Western Europe. The phosphate will be carried from Ashdod in 30,000-dwt carriers. Both ports have modern loading and discharge facilities.[8]

Haifa Chemicals Ltd. brought its potassium nitrate plant on stream in June at about 50,000 tons yearly, half the full rated capacity. Full capacity operations were scheduled for 1972. Phosphoric and nitric acid plants were also completed during the year. Potash is from the DSW; ammonia is imported pending completion of a plant under construction. Phosphate is from the Oron mines.[9] Total investment in the project is $13 million, $5 million of which was from French bank loans. Engineering work for the project was by Krebs et Cie., Paris.

Israel Chemicals Ltd., the holding company comprising the major fertilizer, chemical, and petroleum operations, sought foreign participation in a proposed $155 million chemical and fertilizer complex at Ashdod.[10]

MINERAL FUELS

Natural Gas.—Production by Naphtha Israel Oil Co. Ltd., the Government-owned gas operator, declined slightly in 1969, owing mainly to a conversion in fuel use from natural gas to oil at the Oron phosphate works.

Naphtha Israel reportedly made a natural gas strike at Gurim, in the Zohar area, near the Dead Sea. The well flowed at 6 million cubic feet per day of 80-percent methane and 20-percent ethane gas from Jurassic limestone at 3,900 feet.[11]

Petroleum.—Small-scale crude oil production from the Heletz and adjacent fields by Lapidot Israel Oil Prospecting Co. Ltd. continued to decline as limited reserves are being depleted. At yearend there were 35 producing wells. Crude reserves were estimated at 13 million barrels.[12] Output from Israeli-occupied Sinai Peninsula, particularly the Belayim field, was not divulged but has been estimated at 17 to 18 million barrels (2.5 million tons) [13] during 1969.

Only four exploratory wells were drilled in 1969—two shallow wells (less than 1,600 feet) by Lapidot and Israel National Petroleum Co. Ltd., one well to 4,500 feet by Naphtha Israel, and one well to 5,260 feet by Belpetco Israel Ltd. Lapidot planned a $3.5 million exploration program in 1970, including a $800,000 seismic survey, mainly in the south, and $2.7 million for 14 wells onshore and offshore, with foreign participation. Belpetco, a Texas independent, planned offshore exploration between Ashkelon and Ashdod, from the drilling ship *Typhoon*. The company was granted a 60-percent interest in permits covering the Israeli coastal area from the Lebanon border to Gaza; Israeli interests retained 30 percent, and Equitex Petroleum Ltd., formed by Equity Funding Corp., acquired 10 percent.[14] Belpetco also reportedly drilled an unsuccessful well off the Sinai coast near El-Arish.

Late in the year, Israeli authorities planned exploratory drilling in the Gulf of

[7] World Mining. V. 6, No. 1, January 1970, p. 50.
[8] Phosphorus and Potassium. No. 39, January–February 1969, p. 50.
[9] Phosphorus and Potassium. No. 41, May–June 1969, pp. 40–41.
[10] Phosphorus and Potassium. No. 45, January–February 1970, p. 6.
[11] Oil and Gas Journal. V. 67, No. 17, Apr. 28, 1969, p. 60.
[12] Oil and Gas Journal. V. 67, No. 52, Dec. 29, 1969, p. 94.
[13] Petroleum Press Service. V. 37, No. 4, April 1970, pp. 126–127.
[14] Petroleum Intelligence Weekly. V. 8, No. 20, May 19, 1969, p. 8.

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Suez, off Sinai Peninsula. A contract was apparently concluded with King Resources Co., Denver, Colorado, through Midbar Ltd., a British affiliate. Midbar reportedly leased a drilling platform from Kenting Ltd. of Canada, and the drilling platform was under tow to the Gulf.

Completion of Israel's new 260-kilometer, 42-inch, Eilat-to-Ashkelon crude oil pipeline apparently was delayed for several months by technical problems. Progress on construction was not reported, but an announcement in October that the two 30-inch tanker-loading sea lines were connected at Ashkelon suggested that the line was near completion. Rated capacity is an initial 400,000 barrels per day and, eventually, 1.2 million barrels per day. Total estimated cost is $113 million, including terminal and storage facilities at Eilat and Ashkelon.[15] The operating company, Eilat-Ashkelon Pipeline Co., a subsidiary of APC Holdings Ltd., a Canadian firm, plans to offer a full transport and trading service, including shipment from original crude oil ports, through the Israeli pipeline, to delivery ports mainly in eastern and western Europe.

Although the sources of crude oil east of Suez and European destinations were not divulged, Israeli authorities reportedly held transit contracts covering the line's initial capacity.[16] Eilat port was under development to handle 250,000-dwt tankers, and Ashkelon for tankers up to 125,000 dwt. A substantial tanker fleet was planned—476,000 dwt in 1969, 912,000 dwt in 1970, and 1,500,000 dwt in 1972.

A modest expansion to 120,000 barrels daily at the Haifa refinery was completed. Approval for Israel's second refinery, a 70,000-barrel-per-day plant at Ashdod, 19 kilometers north of the Ashkelon terminal, was announced late in the year. Construction presumably will start during 1970.

Domestic consumption of refinery products continued upward. Estimated demand, including bunkers, for Israel and the occupied territories during 1969 was as follows (in thousand barrels): Gasoline 3,859, kerosine 3,441, distillate fuel oil 5,505, residual fuel oil 14,645, liquefied petroleum gas 1,322, bitumen 764, and other 693, for a total of 30,229 barrels. Sales of the three marketing companies (Paz Oil Corp. Ltd., Delek Israel Fuel Corp. Ltd., and Sonol Israel Oil Co, Ltd.) totaled $177 million, compared with $161 million in 1968, according to the Israel Petroleum Institute.[17]

[15] Middle East Economic Survey. V. 13, No. 18, Feb. 27, 1970, pp. 1–3.
[16] Petroleum Intelligence Weekly. V. 9, No. 8, Feb. 23, 1970, p. 5.
[17] Work cited in footnote 13.

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The Mineral Industry of Italy

By Roman V. Sondermayer [1]

During 1969 Italy remained basically a large processor of imported raw minerals and a significant consumer and exporter of mineral and metal semimanufactures and finished products.

Most significant among the mineral commodities produced in Italy were antimony, asbestos, cement, fluorspar, iron and steel products, lead and zinc, mercury, marble, natural gas, petroleum refinery products and potassium salts. Except for fluorspar, marble, and cement, however, imports were essential to satisfy domestic requirements.

The iron and steel industry and petroleum refining were among the most dynamic branches of the mineral industry. Although there is minor production of iron ore and crude oil in Italy, both industries are largely based on imported raw materials.

The mining industry continued to play a relatively small role in Italy's growing industrial economy. In 1969, mining provided only 0.7 percent of Italy's gross national product (GNP). Although substantial new investments and modernization programs were underway in many mining sectors, domestic output provided an ever smaller percentage of the country's mineral requirements.

The most important events during 1969 in the Italian mineral industry included conclusion of a contract with the U.S.S.R. for deliveries of natural gas (100,000 million cubic meters over the next 20 years); completion of a LD (Linz-Donawitz) oxygen shop at the Aosta steel plant of Nazionale Cogne; installation of a third 300-ton LD converter at the Taranto integrated iron and steel works of Italsider; construction of a 600,000-ton-per-year alumina plant and a 100,000-ton-per-year aluminum smelter in Sardinia; and construction of a 35,000-ton-per-year aluminum smelter in Fusina.

PRODUCTION

Quantitatively, output of the Italian mining industry in 1969 was 4.7 percent more than that of the previous year and value increased 4.2 percent. Total added value in the mining industry was equivalent to U.S.$513.6 million.

Performance of the different sectors of the mining and minerals processing industries are shown by indices in the following tabulation:

Sector	Index (1966 = 100)	
	1968	1969
Mining:		
Metallic minerals	101.9	104.4
Nonmetallic minerals	108.4	111.0
Marble, building stone	133.9	137.3
Solid fuels	124.9	127.1
Petroleum and natural gas	111.0	125.3
Total mining	117.3	122.0
Processing:		
Ferrous metals	126.7	126.4
Nonferrous metals	116.9	123.0
Chemical fertilizers	114.2	99.5
Petroleum refineries	117.5	130.0
Coke plants	102.7	106.1
Cement	131.7	139.3

[1] Petroleum engineer, Bureau of Mines, Washington, D.C.

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Table 1.—Italy: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
METALS				
Aluminum:				
Bauxite		242,027	216,197	215,051
Alumina, anhydrous		285,506	293,825	290,979
Metal:				
Primary		127,778	142,348	144,159
Secondary		102,000	102,000	128,000
Antimony, mine output, metal content		367	785	1,154
Cadmium, metal		218	250	424
Copper:				
Mine output, metal content		1,680	2,304	2,402
Precipitate		2,873	3,300	2,400
Metal:				
Primary e		200	-------	-------
Secondary		17,500	18,000	16,500
Iron and steel:				
Iron ore and concentrates e 1	thousand tons	1,087	1,058	762
Roasted pyrite	do	738	862	e 900
Pig iron	do	7,294	7,826	7,781
Ferroalloys	do	170	168	167
Steel ingots and castings	do	15,890	16,964	16,428
Steel semimanufactures:				
Wire rod	do	771	805	e 800
Other bar and rod	do	4,018	4,402	4,500
Sections	do	r 458	477	e 480
Plates and sheets	do	r 1,348	1,430	1,380
Coils	do	4,033	4,527	4,487
Strip	do	611	627	684
Seamless tubes	do	852	863	834
Other	do	148	192	254
Total hot rolled	do	r 12,239	13,323	13,419
Castings and forgings	do	298	319	333
Cold-rolled sheet	do	2,685	2,781	3,437
Lead:				
Mine output, metal content		38,670	36,475	36,982
Metal:				
Primary		60,498	57,554	62,325
Secondary		11,800	18,600	17,700
Magnesium, metal		6,317	6,593	6,434
Manganese ore		47,098	50,821	52,966
Mercury, metal	76-pound flasks	48,066	53,317	48,733
Silicon, elemental		19,821	NA	19,193
Silver, metal	thousand troy ounces	1,382	1,156	1,832
Zinc:				
Mine output, metal content		124,700	139,800	132,529
Metal, primary		89,026	112,274	130,321
NONMETALS				
Asbestos		101,062	r 103,437	112,453
Barite		154,066	203,980	241,908
Cement, all kinds	thousand tons	26,245	29,540	31,310
Clays:				
Bentonite	do	245	261	210
Fire clay	do	266	265	291
Fuller's earth	do	93	66	69
Kaolin	do	88	82	96
Other e	do	26	30	30
Diatomite		59,954	57,539	e 60,000
Feldspar		147,462	168,382	211,179
Fertilizer materials:				
Crude potassium salts, natural	thousand tons	1,818	1,929	1,954
Manufactured:				
Nitrogenous, gross weight	do	3,435	3,554	3,130
Phosphatic, all kinds	do	1,575	1,625	1,426
Potassic, all kinds	do	324	335	343
Mixed and unspecified	do	1,942	2,101	1,745
Fluorspar, all grades		205,196	224,931	258,085
Graphite, all grades		1,877	1,412	1,719
Lime (quick lime and hydrated lime)	thousand tons	e 4,900	e 5,000	5,795
Pumice		495,349	636,600	e 600,000
Pyrite all kinds:				
Gross weight	thousand tons	1,411	1,406	1,475
Sulfur content	do	635	633	619
Quartz, glass sand	do	3,225	NA	NA
Salt:				
Marine, crude	do	1,274	e 1,300	1,146
Other, including brine	do	2,577	2,626	2,795

See footnotes at end of table.

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Table 1.—Italy: Production of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
NONMETALS—Continued				
Stone, sand, and gravel n.e.s.:				
Dimension stone:				
Limestone and other calcareous:				
Marble in blocks	thousand tons	1,252	1,390	NA
Travertine and tufa	do.	1,487	4,680	NA
Strontium minerals		660	778	e 780
Sulfur, native:				
Ore		488,220	541,098	419,068
Concentrate (90 percent sulfur)		73,492	90,506	64,046
Fused, in briquets		9,836	7,027	NA
Talc and related materials		118,467	115,859	136,501
MINERAL FUELS AND RELATED MATERIALS				
Asphaltic and bituminous rock:				
For distillation		236,162	201,604	NA
For paving		70,774	76,760	NA
Carbon black		90,605	93,310	104,252
Coal:				
Subbituminous (Sulcis coal)	thousand tons	410	365	303
Lignite	do.	2,201	1,728	1,933
Coke:				
Metallurgical	do.	6,246	6,476	6,670
Gas	do.	317	269	194
Gas:				
Natural gas, gross production	million cubic meters	9,367	10,413	11,800
Natural gas liquids		106,810	121,189	NA
Petroleum:				
Crude oil	thousand tons	1,616	1,506	1,480
Refinery products:				
Liquefied petroleum gas	do.	1,605	r 1,702	1,864
Gasoline	do.	11,693	r 12,529	12,601
Kerosine and jet fuel	do.	3,475	4,326	4,935
Distillate fuel oils	do.	r 15,961	r 17,657	19,889
Residual fuel oils	do.	r 43,253	r 44,752	49,318
Lubricants	do.	446	r 496	525
Asphalt and bitumen	do.	1,483	r 1,709	2,042
Other	do.	3,366	6,031	7,851
Total	do.	r 81,282	r 89,202	99,025
Refinery fuel and losses	do.	5,173	5,566	5,853
Refinery throughput	do.	r 86,455	r 94,768	104,878

e Estimate. p Preliminary. r Revised. NA Not available.
1 Including pelletized iron oxide derived from pyrite.

TRADE

During 1969 Italy had an intensive trade in mineral commodities, as in the past. However, labor difficulties adversely influenced the mineral trade balance, because larger imports were necessary. Principal trading partners, as in the past, were the United States and the countries of the European Economic Community. Value of mineral commodity trade is shown in the following tabulation:

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Commodity	Value (million dollars) [1]			
	Exports		Imports	
	1968	1969	1968	1969
METALS				
Ferrous: [2]				
Iron ore	(3)	(3)	$101.1	$104.4
Other	$396.7	$389.4	623.8	834.1
Nonferrous [2]	225.0	282.7	584.4	671.6
Total	621.7	672.1	1,309.3	1,610.1
NONMETALS				
Crude	30.2	35.3	128.7	136.0
Processed:				
Fertilizers	74.7	56.3	13.9	18.0
Other	299.8	370.8	128.9	159.6
Total	404.7	462.4	271.5	313.6
MINERAL FUELS AND RELATED MATERIALS				
Coal	0.2	0.1	148.5	162.0
Coke	6.0	8.8	7.7	5.0
Crude oil	(3)	(3)	1,430.9	1,553.3
Petroleum refinery products	602.2	588.2	88.3	84.4
Total	608.4	597.1	1,675.4	1,804.7
Grand total	1,634.8	1,731.6	3,256.2	3,728.4

[1] Values converted from Italian lira to U.S. dollars at the rate of US$1.00 = Lit. 625.
[2] Includes ores, scrap, unwrought, and semimanufactures of metals indicated.
[3] Less than ½ unit.

Source: Central Institute of Statistics (Instituto Centrale di Statistica—ISTAT). (Rome). Monthly Statistics of Foreign Trade (Statistica Mensile del Commercio con il' Estero). Year 35, ser. 5, No. 12.

Table 2.—Italy: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum:			
Bauxite		320	-------
Oxide and hydroxide		10,672	11,620
Metal, including alloys:			
Scrap		98	264
Unwrought		4,947	25,378
Semimanufactures		29,946	43,896
Cadmium, metal including alloys, all forms		75	10
Copper:			
Ore and concentrate		6,101	8,194
Matte		45	107
Metal, including alloys:			
Scrap		277	871
Unwrought		11,140	8,016
Semimanufactures		29,946	32,566
Germanium	kilograms	NA	4,100
Iron and steel:			
Ore and concentrates	thousand tons	19	-------
Roasted pyrite	do	718	632
Metal:			
Scrap	do	3	7
Pig iron, including cast iron, spiegeleisen, power and shot	do	3	22,717
Ferroalloys:			
Ferromanganese	do	10	11
Other ferroalloys	do	9	9
Steel primary forms	do	161	328
Semimanufactures:			
Bars, rods, angles, shapes, sections	do	554	617
Universals, plates and sheets	do	699	714
Hoop and strip	do	58	68
Rails and accessories	do	10	13
Wire	do	16	24
Tubes, pipes, and fittings	do	563	646
Castings and forgings unworked	do	8	5
Total semimanufactures	do	1,908	2,087

See footnote at end of table.

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Table 2.—Italy: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS—Continued		
Lead:		
Ores and concentrates	8,458	3,297
Metals, including alloys:		
Unwrought	292	77
Semimanufactures		205
Magnesium, metal including alloys:		
Scrap	297	20
Unwrought	3,184	7,112
Semimanufactures	NA	100
Manganese:		
Ore and concentrate	300	22
Metal, all forms	10	40
Mercury, 76-pound flasks	36,931	34,673
Nickel:		
Metal, including alloys:		
Unwrought, including alloys	157	35
Semimanufactures	842	655
Platinum-group metals and silver:		
Metals, including alloys:		
Platinum group, thousand troy ounces	37	28
Silver, do.	48	1,774
Selenium, elemental, kilograms	1,082	400
Silicon, elemental	9,116	10,735
Tin metal, all forms, long tons	127	318
Titanium oxides	17,685	21,921
Tungsten:		
Ore and concentrates	30	------
Metal, including alloys all forms	31	17
Zinc:		
Ore and concentrate	22,258	32,186
Metal, including alloys:		
Blue powder	435	1,661
Unwrought	634	892
Semimanufactures		249
NONMETALS		
Abrasives, natural all kinds, except dust and powder of precious and semiprecious stones	274,403	316,383
Dust and powder of precious and semiprecious stone, kilograms	475	14
Grinding and polishing wheels and stones	3,281	3,861
Asbestos	34,026	41,829
Barite and witherite	40,950	38,489
Cement	413,545	280,750
Chalk	587	706
Clays:		
Bentonite	27,020	18,610
Kaolin	336	540
Other	21,400	30,042
Products:		
Refractory (including nonclay bricks)	32,584	33,023
Nonrefractory	409,775	439,648
Diamond:		
Gem, not set or strung, value, thousands	$105	------
Industrial, carats	15,000	NA
Diatomite and other infusorial earths	1,647	3,480
Feldspar	24,812	25,179
Fertilizer materials:		
Manufactured:		
Nitrogenous, thousand tons	1,174	1,182
Potassic, do.	127	19
Other, do.	406	63
Fluorspar	85,277	83,841
Graphite, natural	1,516	1,568
Gypsum and plaster	16,411	27,857
Lime	62,045	67,476
Magnesite	87	80
Mica:		
Crude, including splittings and waste	328	84
Worked, including agglomerated splittings	27	201
Precious and semiprecious stone, except diamond:		
Natural, kilograms	2,551	453
Manufactured, do.	991	134
Pyrite (gross weight)	52,085	48,497
Salt, all forms	45,643	20,357

See footnote at end of table.

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Table 2.—Italy: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
NONMETALS—Continued			
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous		274,924	281,337
Slate		6,391	4,073
Other		27,534	40,706
Worked, all forms		339,614	392,693
Dolomite, all grades		15,156	14,667
Gravel and crushed rock		398,525	422,762
Limestone (except dimension)		1,215	1,460
Quartz and quartzite		21,172	28,231
Sand, excluding metal bearing		180,662	366,614
Strontium minerals		119	81
Sulfur, elemental, all forms		2,486	4,330
Talc, steatite and soapstone		32,532	40,427
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		7,422	9,536
Carbon black		21,812	25,416
Coal, all grades, excluding briquets		3,045	4,053
Coke and semicoke		218,684	233,974
Petroleum, refinery products:			
Liquefied petroleum gases	thousand tons	217	226
Gasoline	do	4,075	5,052
Kerosine and jet fuel	do	1,108	1,979
Distillate fuel oil	do	8,205	10,570
Residual fuel oil	do	7,453	9,163
Lubricants	do	390	375
Bitumen and other	do	275	315
Total	do	21,723	27,680

NA Not available.

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Table 3.—Major destinations of selected mineral commodity exports, 1968

(Metric tons unless otherwise specified)

Commodity	Quantity
METALS	
Aluminum:	
Metal including alloys:	
Unwrought, total	25,378
West Germany	19,616
Argentina	2,870
France	1,264
Semimanufactures, total	43,896
United States	10,968
West Germany	8,109
France	3,723
Yugoslavia	2,716
Rumania	2,496
Copper:	
Ores and concentrates, total	8,194
West Germany	3,567
Spain	2,521
Metal, including alloys:	
Unwrought, total	8,016
West Germany	2,510
Belgium-Luxembourg	1,783
Semimanufactures, total	32,566
France	4,987
Rumania	4,918
West Germany	4,906
Switzerland	2,363
Iron and steel:	
Metal:	
Steel, primary forms, total thousand tons	328
United States do	91
Spain do	58
France do	55
Israel do	43
West Germany do	5
Semimanufactures, total do	2,087
West Germany do	437
France do	212
United States do	153
Libya do	149
Yugoslavia do	115
Mercury, total 76-pound flasks	34,673
United Kingdom do	7,133
Japan do	6,153
East Germany do	2,883
United States do	2,753
West Germany do	2,602
India do	1,813
Poland do	1,435
Tin, metal, all forms, total long tons	318
France do	188
Austria do	46
Zinc:	
Ore and concentrate, total	32,186
Austria	10,713
South Africa	10,500
Yugoslavia	10,080
Metal, including alloys:	
Unwrought, total	892
West Germany	609
NONMETALS	
Asbestos, total	41,829
West Germany	17,452
NONMETALS—Continued	
Asbestos, total—Continued	
France	7,869
Netherlands	4,207
Belgium-Luxembourg	2,964
Cement, total	280,750
Libya	123,393
France	27,967
Spain	24,796
Nigeria	19,464
Lime, total	67,476
Libya	52,184
Switzerland	14,150
Pyrite (gross weight), total	48,497
Switzerland	42,138
Austria	5,083
MINERAL FUELS AND RELATED MATERIALS	
Coke and semicoke, total	233,974
Portugal	64,026
Austria	37,747
France	29,139
Yugoslavia	28,316
Petroleum:	
Refinery products:	
Gasoline, total thousand tons	5,052
United Kingdom do	1,144
Belgium-Luxembourg do	917
Sweden do	526
Netherlands do	518
Switzerland do	444
Kerosine and jet fuels, total do	1,979
Netherlands do	198
Belgium-Luxembourg do	195
Greece do	164
United Kingdom do	132
Switzerland do	128
Distillate fuel oil, total do	10,570
West Germany do	2,318
Belgium-Luxembourg do	1,950
Netherlands do	1,540
Switzerland do	1,198
France do	850
United Kingdom do	479
Sweden do	344
Residual fuel oil, total do	9,163
United States do	2,746
United Kingdom do	711
Belgium-Luxembourg do	460
Yugoslavia do	312
Greece do	310
France do	183
West Germany do	154
Lubricants, total do	375
United States do	71
Belgium-Luxembourg do	42
Netherlands do	40
Switzerland do	32
France do	27

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Table 4.—Italy: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite	543,203	585,924
Oxide and hydroxide	35,087	54,200
Metals, including alloys:		
Scrap	64,867	43,790
Unwrought	82,131	85,860
Semimanufactures	26,350	23,970
Antimony:		
Ore and concentrate	773	183
Metal, including alloys, all forms	614	166
Beryllium:		
Oxide kilograms	3,080	1,980
Metal, including alloy, all forms do	6,425	600
Bismuth metal, including alloys, all forms	55	78
Cadmium	99	16
Chromium:		
Chromite	94,823	163,089
Oxide and hydroxide	887	1,029
Metals, including alloys, all forms	61	79
Cobalt:		
Oxide and hydroxide	236	243
Metals, including alloys, all forms	332	344
Copper:		
Ores and concentrates	301	131
Matte	126	126
Metal, including alloys:		
Scrap	33,476	42,130
Unwrought	234,981	226,255
Semimanufactures	10,584	10,432
Gallium, indium, and thalium kilograms	643	400
Germanium do	1,095	1,300
Iron and steel:		
Ores and concentrates thousand tons	9,926	10,068
Roasted pyrites do	119	-------
Metal:		
Scrap do	4,969	5,085
Pig iron, including cast iron and spiegeleisen do	1,072	883
Sponge iron, powder shot do	11	23
Ferroalloys:		
Ferromanganese do	87	87
Other do	65	80
Steel, primary forms do	1,288	1,130
Semimanufactures:		
Bars, rods, angles, shapes, sections do	529	497
Universals, plates and sheets do	1,005	910
Hoop and strip do	106	77
Rails and accessories do	48	57
Wire do	23	24
Tubes, pipes, and fittings do	93	107
Castings and forgings do	2	4
Total semimanufactures do	1,806	1,676
Lead:		
Ores and concentrates	20,850	54,308
Ashes and residues containing lead	2,192	4,465
Metal including alloys:		
Scrap	30,229	18,861
Unwrought	60,397	55,214
Semimanufactures	1,787	661
Magnesium metal, including alloys:		
Scrap	47	145
Unwrought	324	221
Semimanufactures	66	72
Manganese:		
Ores and concentrates	152,965	169,560
Oxides	r1,344	1,240
Metal, all forms	1,407	1,101
Mercury 76-pound flasks	1,160	643
Molybdenum:		
Ore and concentrate	2,519	1,065
Metal, including alloys, all forms	25	45
Nickel:		
Matte, speiss, and similar materials	1,805	4,404
Metals, including alloys:		
Scrap	1,555	1,429
Unwrought	12,061	13,547
Semimanufactures	2,127	2,068

See footnotes at end of table.

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Table 4.—Italy: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS—Continued		
Platinum-group metals and silver:		
Metals, including alloys:		
Platinum group—thousand troy ounces	214	50
Silver—do	30,040	21,216
Selenium, elemental	21	22
Silicon, elemental	NA	804
Tin:		
Metal, including alloys:		
Scrap—long tons	19	44
Unwrought—do	6,107	7,062
Semimanufactures—do	82	45
Titanium:		
Ore and concentrates	106,398	137,851
Oxides	21,147	24,170
Metal, including alloys, all forms	378	203
Tungsten:		
Ore and concentrate	46	54
Metal, including alloys, all forms	81	107
Uranium and thorium:		
Ore and concentrate	102	-------
Metal, including alloys, all forms—kilograms	339	200
Zinc:		
Ore and concentrates	21,418	26,061
Ashes and residues containing zinc	9,396	NA
Metal, including alloys:		
Scrap	8,040	6,970
Blue powder	2,887	3,375
Unwrought	66,006	42,296
Semimanufactures	712	371
Zirconium:		
Ore and concentrate	17,804	17,003
Oxides	435	236
Metal, including alloys, all forms—kilograms	4,589	5,800
NONMETALS		
Abrasives all kinds, except dust of precious and semiprecious stones and grinding and polishing wheels and stones	8,069	8,987
Dust and powder of precious and semiprecious stones—value, thousands	$1,929	$99,936
Grinding and polishing wheels and stones	3,803	3,650
Asbestos	45,430	51,272
Barite and witherite	6,708	5,898
Borates, crude, natural	70,753	81,999
Cement	72,625	132,276
Chalk	6,351	6,540
Clays and clay products:		
Clays:		
Bentonite	7,536	-------
Kaolin	377,836	457,738
Other	546,218	623,000
Products:		
Refractory (including nonclay bricks)	63,669	68,944
Nonrefractory	12,216	15,887
Cryolite and chiolite	633	NA
Diamond:		
Gem not set or strung—value, thousands	$3,664	$4,827
Industrial—kilograms	12,120	14,146
Feldspar	17,188	12,272
Fertilizer materials:		
Crude:		
Nitrogenous	21,154	-------
Phosphatic—thousand tons	1,900	2,162
Potassic	44,759	51,207
Manufactured:		
Nitrogenous	5,431	11,453
Phosphatic	143,075	141,831
Potassic	206,016	206,308
Other	33,079	28,769
Fluorspar	32,889	21,613
Graphite, natural	13,785	13,575
Gypsum and plaster	1,621	1,373
Magnesite	52,979	53,686
Mica:		
Crude, including splittings and waste	2,777	NA
Worked, including agglomerated splittings	136	170
Precious and semiprecious stone, except diamond:		
Natural—value, thousands	$739	$857
Manufactured—do	$1,360	$1,268

See footnotes at end of table.

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Table 4.—Italy: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
NONMETALS—Continued			
Pyrite, gross weight	thousand tons	1,250	1,099
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous, including marble		131,105	119,598
Slate		1,361	9,543
Other		57,106	68,437
Worked, all types		893	1,020
Dolomite		1,424	1,530
Gravel and crushed rock		13,159	15,075
Quartz and quartzite		41,490	55,939
Sand, excluding metal bearing		845,291	930,854
Sulfur, elemental, all forms		78,359	146,332
Talc, steatite, soapstone and pyrophyllite		14,196	15,879
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen		3,353	2,062
Carbon black		24,215	15,787
Coal and briquets:			
Anthracite and bituminous	thousand tons	11,813	10,542
Briquets of bituminous coal and anthracite	do	81	62
Lignite and lignite briquets	do	274	202
Coke and semicoke	do	352	314
Peat, including briquets	do	11	11
Petroleum:			
Crude and partly refined	do	86,439	87,109
Refinery products:			
Liquefied petroleum gases	do	37	NA
Gasoline, all kinds	do	98	45
Kerosine and jet fuels	do	28	27
Distillate fuel oils	do	659	271
Residual fuel oils	do	2,724	3,384
Lubricants	do	125	146
Mineral jelly and wax	do	40	42
Other:			
Petroleum coke	do	269	313
Bitumen and other residues	do	179	101

r Revised. NA Not available.

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Table 5.—Major origins of selected mineral commodity imports, 1968

(Metric tons unless otherwise specified)

Commodity	Quantity
METALS	
Aluminum:	
Bauxite, total	585,924
Yugoslavia	252,961
Sierra Leone	137,116
Indonesia	82,232
India	59,151
Guyana	40,508
Metals, including alloys:	
Scrap, total	43,790
Canada	10,520
France	9,623
West Germany	3,890
Hungary	3,585
Yugoslavia	3,280
Unwrought, total	85,860
France	17,725
Norway	14,750
Netherlands	7,130
Yugoslavia	6,336
Semimanufactures, total	23,970
West Germany	7,747
France	5,740
Greece	3,442
Chromium:	
Chromite, total	163,089
U.S.S.R.	54,089
Albania	37,725
Brazil	32,000
Turkey	16,544
Copper:	
Metals, including alloys:	
Scrap, total	42,130
West Germany	11,587
United States	9,666
France	7,172
Canada	4,480
Unwrought, total	226,255
Zambia	55,663
Chile	47,884
Congo (Kinshasa)	36,803
United States	26,651
United Kingdom	17,884
Semimanufactures, total	10,432
Yugoslavia	2,741
West Germany	2,306
Switzerland	1,192
Iron and steel:	
Ores and concentrates, total thousand tons	10,068
Liberia do	2,154
Canada do	1,272
Brazil do	1,248
Algeria do	1,155
Venezuela do	968
Mauritania do	938
Metal:	
Scrap, total do	5,085
France do	1,895
West Germany do	1,713
United States do	582
United Kingdom do	316
U.S.S.R. do	187
Canada do	94
Pig iron, cast iron and spiegeleisen, total do	883
West Germany do	386
U.S.S.R. do	186
Finland do	123
East Germany do	32
Steel, primary forms, total thousand tons	1,130
West Germany do	365
France do	201
Belgium-Luxembourg do	189
METALS—Continued	
Iron and steel—Continued	
Semimanufactures, total do	1,676
West Germany do	504
France do	362
Belgium-Luxembourg do	285
Lead:	
Ores and concentrates, total	54,308
Morocco	27,378
Ireland	12,472
Canada	5,915
Greece	4,553
Metals, including alloys:	
Scrap, total	18,861
France	7,122
Switzerland	4,074
West Germany	3,940
Unwrought, total	55,214
Mexico	12,441
South Africa	12,214
Bulgaria	10,988
Semimanufactures, total	661
West Germany	182
Manganese:	
Ores and concentrates, total	169,560
South Africa	50,804
Mainland China	36,250
Australia	26,634
U.S.S.R.	25,298
Nickel:	
Matte, speiss and similar materials, total	4,404
Cuba	2,549
Canada	1,679
Metals, including alloys:	
Scrap, total	1,429
United States	1,176
Switzerland	140
Unwrought, total	13,547
United Kingdom	3,493
U.S.S.R.	2,024
Canada	1,800
United States	1,594
Semimanufactures, total	2,068
West Germany	587
United Kingdom	462
United States	407
France	245
Tin, metal including alloys, unwrought, total long tons	7,062
Malaysia do	4,393
Thailand do	1,207
Netherlands do	549
Zinc:	
Ore and concentrates, total	26,061
Algeria	13,180
Morocco	6,275
Tunisia	3,200
Metal, including alloys:	
Scrap, total	6,970
West Germany	2,879
France	2,271
Blue powder, total	3,375
Belgium-Luxembourg	2,988
Unwrought, total	42,296
West Germany	5,937
Yugoslavia	5,410
Belgium-Luxembourg	4,174
Congo (Kinshasa)	3,931
NONMETALS	
Asbestos, total	51,272
South Africa	27,029
Canada	14,183
U.S.S.R.	8,275

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Table 5.—Major origins of selected mineral commodity imports, 1968—Continued

(Metric tons unless otherwise specified)

Commodity	Quantity
NONMETALS—Continued	
Cement, total	132,276
Israel	76,721
France	41,686
Tunisia	8,478
Yugoslavia	3,865
Fertilizer materials:	
Crude:	
Phosphatic, total thousand tons	2,162
United States do	1,295
Morocco do	444
U.S.S.R. do	177
Tunisia do	95
Israel do	85
Potassic, total	51,207
France	39,651
East Germany	6,280
Manufactured:	
Nitrogenous, total	11,458
Austria	3,357
Belgium-Luxembourg	2,660
France	2,133
Phosphatic, total	141,831
Belgium-Luxembourg	77,509
France	37,506
United States	14,965
Other total	28,769
West Germany	11,832
Belgium-Luxembourg	5,445
Austria	4,163
France	3,553
MINERAL FUELS AND RELATED MATERIALS	
Asphalt and bitumen, total	2,062
United States	1,877
Coal and briquets:	
Anthracite and bituminous coal, total thousand tons	10,542
United States do	3,604
West Germany do	2,800
Poland do	1,927
U.S.S.R. do	1,591

Commodity	Quantity
MINERAL FUELS AND RELATED MATERIALS—Continued	
Petroleum:	
Crude and partly refined, total thousand tons	87,109
Libya do	20,555
Iraq do	16,582
Kuwait do	15,749
Saudi Arabia do	11,663
U.S.S.R. do	10,979
Iran do	3,707
Venezuela do	1,928
Refinery products:	
Gasoline all kinds, total do	45
Netherlands Antilles do	10
United States do	8
United Kingdom do	6
Kerosine and jet fuel, total do	27
Libya do	5
Trinidad do	4
Netherlands do	2
Distillate fuel oils, total do	271
Yugoslavia do	147
Tunisia do	49
U.S.S.R. do	44
Residual fuel oils, total do	3,384
U.S.S.R. do	948
Rumania do	406
Yugoslavia do	339
United Kingdom do	338
France do	166
Lubricants, total do	146
United States do	52
West Germany do	43

Source: United Nations, Department of Economic and Social Affairs, Statistical Office of the United Nations, Commodity Trade Statistics, according to the Standard International Trade Classification. Statistical Papers, Ser. D., v. 17, Nos. 1–26, 1969, pp. 6786–7041.

COMMODITY REVIEW

METALS

Aluminum.—Domestic bauxite output continued its slow decline, necessitating even greater bauxite imports in 1969 to support the growing aluminum industry. The gradual exhaustion of the S. Giovanni Rotondo mine, operated by Montecatini-Edison S.p.A. (Montedison), was the major factor contributing to the decline in bauxite production during the year.

Additional domestic bauxite sources were the Palmariggi, Poggiardo, and Otranto mines operated by Società Montevergine. Exploration for additional reserves at the Melodia and Senadico mines operated by Società Alluminio Veneto Anonima (SAVA) proved negative. To insure a supply of high-quality bauxite from Guinea, Montedison acquired a 6-percent participation in the international consortium, Halco Mining, Inc. The consortium will exploit the large Boke bauxite deposits through the Guinean Compagnie des Bauxites de Guinée. Deliveries should start in late 1972.

Construction of a new alumina plant in Sardinia at Porto Vesme, near Porto Scuso, started in 1969. The plant, scheduled for completion in 1972, will have an annual capacity of 600,000 tons of alumina. It will be operated by an international consortium, Euroalumina Company (Alsar has the main interest, 52 percent), to which the European Investment Bank granted a loan of $24.9 million. The plant will be supplied with bauxite brought from Weipa in Queensland, Australia, in 70,000-ton freighters now under construction in Italy.

Montedison's new aluminum smelter at Fusina (Venice) was under construction during 1969. The smelter will have an annual capacity of 35,000 tons of aluminum and a potential for gradual expansion.

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Production is expected to start in 1970. The Fusina plant will have high-amperage pots and will be highly automated, using Montecatini-Edison technology. Moreover, a further increase in aluminum metal production can be expected in 1971 when Società Alsar's 100,000-ton-per-year capacity aluminum smelter is slated for completion at Porto Vesme in Sardinia. Future expansion of this plant may bring its annual capacity to 200,000 tons per year of aluminum. Italy's aluminum requirements totaled 256,000 tons of primary metal in 1969 with no substantial changes in the principal sectors of consumption. Growth of consumption has been particularly remarkable in the building industry.

Antimony.—According to Italian reports new stibnite deposits were discovered at Poggio Bellino in the general area of Italy's largest antimony mine, Tafone, owned by Azienda Minerali Metallici Italiane S.p.A. (AMMI), a State-owned company and the largest producer of antimony. At the yearend, reserves had not been determined.

Production of antimony in Sardinia came to an end in 1969 because economic reserves were exhausted.

Iron and Steel.—In spite of favorable economic conditions, loss of production from strikes in the fall of 1969 caused output in the iron and steel industry to fall below record levels of 1968.

Although a large number of plants underwent expansion and modernization, principal activities were concentrated around the Italsider S.p.A. plant at Taranto, where a new converted and new blast furnace were completed in 1969. Reportedly the overall construction program at Taranto may be completed in 1972 with a total cost of about $320 million.

The Italian iron and steel industry operated the following facilities during 1969:

Type of facility	Number of units
Pig iron:	
Blast furnaces	17
Electric pig iron furnaces	13
Steel:	
Open-hearth furnaces	36
Electric steel furnaces	265
LD converters	11
Foundries, steel	60
Rolling facilities all kinds	314

Source: Associazione Industrie Siderurgiche Italiane (ASSIDER), Milan. Repertorio delle Industrie Siderurgiche Italiane anno 1969, p. 785.

During 1969 the industry had a total capacity of 8.8 million tons of pig iron and about 19.7 million tons of steel ingots. There were 370 ferrous metallurgical installations operated by about 317 companies, of which the most important were Italsider S.p.A., Fait, A.F.L. Falck, Dalmine, and Cogne. The province of Lombardia was the location of the largest number of plants. However, development in the provinces of Campania, and Puglie increased Southern Italy's share in the country's total output of steel and steel products.

Iron Ore and Other Raw Materials.—The dynamic Italian iron and steel industry continued to depend on imported iron ore for about 90 percent of its requirements in 1969. Domestic mine output of iron and manganese ores increased slightly, but both manganese ore and chromite had to be imported. Imports of scrap accounted roughly for about 50 percent of total estimated scrap consumption; however, the use of scrap per ton of steel produced declined in line with the increased use of oxygen converters. This trend is expected to continue.

Pig Iron.—Italsider remained by far the largest producer of pig iron in Italy, accounting for 96 percent of total output. Nazionale Cogne an Acciaierie Ferriere Lombarde Falck produced most of the remainder.

Since the demand continued to trend upward, construction of new blast furnaces and modernization of existing plants continued during the year. At Trieste, Italsider completed the rebuilding of furnace No. 2. With this furnace, the annual capacity of the Servola works reached 520,000 tons of pig iron per year. A new blast furnace was completed at the Italsider Taranto plant. This furnace has a daily capacity of 4,100 tons and a diameter of 10.6 meters; all operations are highly automated with electronic controls.

Plans call for an expansion of Italsider's pig iron capacity to 10 million tons by 1972.

Crude Steel.—Italsider, which operated 10 metallurgical plants located throughout the country and is one of the largest steel producers in Italy, continued to expand its production capacity. At the integrated iron and steel works near Taranto, a new 300-ton LD converter went on stream during 1969 with a maximum daily capacity of

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7,800 tons. The converter is expected to operate 235 days during a calendar year.

During 1969 Italsider S.p.A. produced slightly more than 50 percent of total Italian output.

Nazionale Cogne completed construction of an oxygen steel works at Aosta. Four Bessemer converters built in 1929 were replaced by two 40-ton LD converters.

Special Steels.—During 1969, production of carbon and alloy steel amounted to 2.3 million tons or about 14 percent of the country's total output of crude steel. The national output of special steel by type in the last 2 years was as follows:

Type	Quantity (thousand metric tons)	
	1968	1969
High carbon steel:		
Structural	895	1,114
Tool	3	3
Total	898	1,117
Alloy steel:		
Structural	858	864
Tool	25	22
Bearing	82	106
Stainless	233	221
High speed	2	2
Other	3	2
Total [1]	1,203	1,218
Grand total [1]	2,101	2,336

[1] Data may not add to totals shown because of independent rounding.

Source: Associazione Industrie Siderurgiche Italiane (ASSIDER; Association of Italian Iron and Steel Industries) Milan. Rilevazione Statistiche, Produzioni, 1968-69.

The largest Italian producer of stainless steel, Società Terni, was investing about $12 million to increase annual production capacity of hot-rolled coils to 71,000 tons by 1972. This firm also was expanding annual production capacity of oriented grain and nonoriented grain magnetic sheets to 65,000 and 200,000 tons, respectively. Completion of this program was scheduled for 1972 at a cost of $10 million.

Rolled Steel and Other Activities.—Italsider was the largest producer of rolled steel, and its plant near Taranto remained the center of activities in the Italian rolled steel industry. Construction of a 500,000-ton cold-rolling mill for sheet and strip continued. The expenditure for the cold-rolling facility reportedly totaled about $72 million.

The Dalmine plant at Taranto added a new welded pipe shop to its facilities during 1969 and began producing welded pipes ranging in diameter from 168 to 508 millimeters.

SILFA—S.p.A. (Industria Lavorazione Ferro e Acciaio) Bari, put on stream a new galvanizing plant at Bari. Annual capacity of the plant was reported to be 2,800 tons of products per year.

Italsider's rolling plant at San Giovanni Valdarno was modernized and emphasis was put on automation.

Italian industrial circles and the authorities were planning expansion of the industry in keeping with the continually expanding demand for iron and steel products. The Government controlled Istituto Ricostruzione Industriale (IRI) was prompted to study the possibility of construction of a fifth large plant or the expansion of the Taranto works to at least double present size and output capacity by 1975. At yearend no decision was announced.

Lead and Zinc.—The production of lead and zinc was the most active branch of the Italian nonferrous industry which was based mostly on domestic resources. In spite of favorable market conditions abroad and at home, the prospects of the domestic lead-zinc industry remained uncertain. The European Economic Community (EEC) has abolished the protective tariffs of 35 lire per kilogram of lead and 25 lire per kilogram of zinc, reducing the tariff to 8.2 lire per kilogram for both metals. In addition, increased labor costs and the decreasing quality of domestic ores, combined with tight money cast a shadow over the future of the industry.

A new company, Piombo Zincifera Sarda S.p.A. (P.Z.S.), was formed late in 1969. The company assumed control of the properties of Società Mineraria e Metallurgica di Pertùsola. However, Pertùsola retains a 25 percent-interest in the new company.

AMMI's Imperial Smelting furnace at Porto Verme was under construction during 1969. The metal production capacity of the plant will be about 105,000 tons per year, consisting of about 60 percent zinc and 40 percent lead. In addition, 100,000 tons of sulfuric acid will be produced. Completion was scheduled for yearend 1970, at a cost of approximately $48 million, an increase of $20.8 million compared with the original estimate.

In addition to new facilities in Sardinia,

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the Sardinian Regional Government, through Ente Mineraria Sarda, plans to unify under a single management the present operations of P.Z.S., AMMI, and Monteponi-Montevecchio S.p.A., the latter a subsidiary of Montedison. In addition, the new organization will place emphasis on exploration in Sardinia.

The Pertùsola company, which accounts for 42 percent of the lead and 44 percent of the zinc output of Italy, intends to increase its mining and metallurgical facilities on the mainland. New zones of mineralization will be brought into production in the province of Belluno, and by 1974 the zinc smelter at Crotone will be enlarged to a capacity of 90,000 tons of metal per year. Additional facilities to be built at Crotone include a new plant for thermal treatment of waste and ashes and production of germanium, a new powerplant, and improvement of port facilities. Raw material for the germanium plant is abundant since operations at Crotone began in 1929. The Crotone project was submitted to the Italian authorities for approval, but no decision was announced by yearend.

In spite of strikes in consuming industries, consumption of lead and zinc increased during 1969 to 137,000 tons of lead and 170,000 tons of zinc. Imports of both metals were necessary to cover the internal demand.

Mercury.—During 1969 the mercury producing sector of the Italian mining industry met serious difficulties, mostly caused by sluggish market conditions and a continuing decline in ore grade. Average mercury content of ore was 0.47 percent in 1969 compared with 0.52 percent in 1968. Some mines, such as Zolfier operated by Soc. SIAM, closed during 1969, and others, such as the Cantobbio mine, operated by Società Mercurifera Italiana, were facing the same fate pending results of exploration.

However, Monte Amiata Company, the principal Italian producer, reopened the Solforate Schwarzenberg, Bagni San Filippo and Monte Labbri II mines in 1969. In addition, extensive exploration at Abbadia San Salvatore and Selvena was continued.

During 1969 reported consumption of mercury amounted to 14,500 76-pound flasks.

NONMETALS

Asbestos.—During 1969 the bulk of Italian asbestos production consisted of short fiber and flour. Only two or three mines near Sondrio and Aosta produced tremolite of long fiber form. All Italian requirements for long fiber asbestos were imported. The principal producer of asbestos in Italy during 1969 remained S.A. Amiantifera di Balangero. This company produces 99 percent of the nation's output.

The Cape Asbestos Co. liquidated its Italian subsidiary, Capamiato S.A. The company was sold to Società Italiana per Amianto, S.A.

Barite.—L'Industrie Mineraria Meridionali S.A., a subsidiary of Monte Amiata, has built a plant in Naples to produce marketable barite. The new plant will process lump barite from the mine at Bagni San Filippo, near Mastricarro in Calabria. Capacity of the Naples plant was reported to be 10,000 metric tons of ground barite per year.

Intensive exploration and expansion of beneficiation facilities were underway at the following mines: the Bergo-Sardinio and Su-Benatzu mines in Sardinia owned by the Eden Company and the Mastricarro Mine (Catanzaro area) owned by the Società Industrie Meridionali Minerarie.

Cement.—Italy remained one of the largest producers of cement in Western Europe, second only to West Germany. Installed production capacity increased by an additional 2.7 million tons (9 rotary kilns), bringing total installed capacity to 36.5 million tons annually. The industry employed about 16,000 persons during 1969, and apparent domestic consumption was estimated at 31.1 million tons.

Fluorspar.—During 1969 Italian fluorspar production was dominated by two companies—Montecatini-Edison and Mineraria Silius of the C. E. Giulini group. Both companies were expanding their production facilities.

Mineraria Silius was deepening the shaft at its fluorspar-barite-lead mine near the village of Silius. Results were favorable and confirmed the economic potential of these deposits in depth. At the Genna Tres Montis mine, a heavy-media-separation plant substantially improved the grade of ore trucked to the flotation plant at Assemini. In addition, Mineraria Silius was constructing a pelletizing plant on the

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Assemini mill site. The plant will produce pellets from flotation concentrates of metallurgical-grade fluorspar.

Montecatini-Edison operated six mines during 1969 and had three properties under development of which deposits around Trento were most important. Lower grade of ore mined during 1969 created some economic problems; however, it was hoped that this situation would be improved by the results of new explorations.

Potassium Salts.—As in the past, all production of potash salts in Italy came from Sicily. Montedison remained the principal producer, with two mines—S. Cataldo and Racalmuto. The rest was produced by Sincat and by Industria Sali Potassici e Affini SpA (ISPEA). ISPEA was building a 230,000-ton potassium sulfate plant near Enna. The plant will process salts from the Pasquasia and Corvillo mines and will require an investment of approximately $32 million.

Pyrite and Sulfur.—Montedison remained the largest producer of pyrite in Italy. Ninety-seven percent of the national output came from the company's mines at Niccioleta, Gavorrano, and Boccheggiano. More than one-half of the production was processed at Scarlino for the production of sulfuric acid and iron oxide pellets. The pelletized iron oxide was used in blast furnaces at Piombino.

Continued exploration to locate new pyrite deposits in Grosseto brought about the discovery of an exploitable field near the old mine of Merse. At a depth of 700 meters, mineralization was located in veins 55 meters thick.

A new company for production of pyrite was organized jointly by AMMI and Montedison. The new company—Società Mineraria dell' Argentario—was headquartered in Grosseto. Each partner has a 49-percent share; the remaining 2 percent was held by a financial company of the Finsider group. The new pyrite operation, located near Lake Orbetello, will have an initial production of 1.5 million metric tons annually. Reserves were estimated at 20 million tons.

The Italian production of sulfur ore continued to decline. Only 12 mines were in operation during 1969, six less than in 1968. Ente Mineraria Siciliano was closing inefficient mines in order to improve productivity and to offset the economic effects caused by rationalization of the sulfur industry and abolishment of protective tariffs.

Italy's brimstone supply is augmented by sulfur recovered from oil refineries where output in 1969 was estimated about 30,000 tons.

Salt.—Development of the salt deposit at Timpa del Salto, near Ciro in Catanzaro Province, continued during 1969. Plans call for the beginning of production in 1970 at the rate of 1.5 million metric tons per year. Cost of the project was estimated at $24 million.

In addition, a salt mine near Realmonte in Agrigento Province of Sicily was developed and prepared for production. The output of salt was expected to be 2 million tons per year.

Other Nonmetals.—Italy produced a large number of other nonmetalic minerals during 1969 such as marble from Carrara, Massa, Versillia, and Garfagnana zones; feldspar from mines located in Trento and Vercelli; graphite from a mine near Pinerolo; and talc and steatite from mines in Piemonte and Sardinia. In Sardinia, SOIM completed exploration for talc near Nuoro. No results were reported at yearend.

MINERAL FUELS

Like all industrialized countries of Western Europe, Italy was a significant energy consumer during 1969 (149 million tons of standard coal equivalent).[2] Since Italy's output of coal and crude oil remained small, domestic production of natural gas and imports of solid and liquid fuels were the pillars of the nation's energy supply. Only about 24 percent of the country's energy requirements were met by domestic producers. The following tabulation shows the share of different sources of energy, in percent of the country's total consumption:

	1965	1968	1969
Solid fuels	12.5	10.7	10.0
Liquid fuels	61.4	65.9	67.5
Natural gas	9.3	10.0	10.0
Nuclear, geothermal, and hydroelectric power [1]	16.8	13.4	12.5
	100.0	100.0	100.0

[1] Roughly about 95 percent is hydroelectric power.

Source: Ministero dell Industria del Commercio dell Artigianato. Direzione Generale delle Fonti di Energia e dell' Industrie di Base. Bollettino Statistico Sulle Fonti di Energia e Sulla Produzione Industriale.

[2] At 7,000 calories per kilogram.

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The recent levels of employment in the fuel and power industries suggest a total employment of slightly more than 1 percent of the industrial labor force.

Coal and Coke.—There were no significant events in the solid fuel sector of the Italian mineral industry during 1969. Domestic output of Sulcis coal and lignite was modest and imports of high-ranking coals were essential. In spite of increased industrial activity and consequently larger energy consumption, the use of coal in all sectors of the industry was declining except in coke production which increased in proportion to the requirements of the metallurgical industries. As compared with coal, the competitive price and greater convenience of liquid fuels were more attractive to Italian consumers.

Increased imports of coal from European sources continued to reduce the share of coal imported from the United States, which amounted to only 28 percent of total Italian coal imports in 1969 as compared with 33 percent in 1968.

Most of the domestic coal and lignite was consumed for electric power generation. Coking facilities were the largest users of imported coals.

Italsider remained the largest coke producer in the country, accounting for about 60 percent of the country's total output. At Piombino steelworks, construction of a new battery of 27 coke oven was continued. Production was expected to start in 1970 at a rate of about 430 tons of coke per day.

Exploration.—Since the country depends heavily on import of fuels, search for new domestic sources of natural gas and crude oil was intensive. While emphasis was on offshore Adriatic structures, seismic exploration onshore in Northern Italy (Po Valley) outlined new promising structural traps, most of them deeper than those drilled thus far. Approximately 236,000 meters were drilled and 69 wells were completed during 1969. Average depth of the wells was 3,420 meters. Three wells were oil producers; gas was found in 35 wells; and 31 wells were dry.

The offshore drilling activities in the Adriatic were carried out with about 10 rigs operated by Agip (subsidiary of Ente Nazionale Idrocarburi-ENI) and Agip-Shell. Apparently, no important discoveries were made although testing results were not completely evaluated by yearend. Off Riccione, the Montedison group (which includes the American firms of Westates Petroleum and Union Oil Co. as well as German, Belgian, and French companies) discovered gas. Tests of the discovery indicated a yield of 53 million cubic feet of gas daily.

During 1969, new licenses for offshore and on-land prospecting were granted. Agip now has 16 licenses, covering 325,128 hectares; Agip-Shell has 41 licenses, totaling 933,673 hectares; while other companies hold a total of 26 licenses, aggregating 589,687 hectares. In addition, the Italian Government issued 15 new licenses totaling 569,725 hectares for oil and gas prospecting on land. To facilitate drilling in the Adriatic, the agreement between Italy and Yugoslavia on delineation of the offshore boundary between the two countries was ratified and was in force at yearend.

With the demand for oil growing constantly, ENI was involved in intensive oil exploration abroad, trying to secure supplies of crude oil for 15 refineries. ENI geological, geophysical, and drilling activities have been very intense in Argentina, with Agip, in partnership with Phillips Petroleum Co., acquiring geophysical exploration permits for the offshore area of Bahia Bianca. In addition, Agip Argentina, which has 50-percent interest in a consortium of Italian and American companies, will participate in petroleum exploration in San Jorge Gulf off the coast of Patagonia.

Agip also had a 28-percent interest in the small Iranian Consortium, which includes French, Spanish, Belgian, and Austrian companies. The Small Consortium signed an agreement with National Iranian Oil Co. for oil exploration in the Zagros mountain area. In addition to successful explorations in Tunisia and Libya, ENI obtained new concessions in Thailand, Norway, and Alaska.

Natural Gas.—Domestic production of natural gas was not sufficient to cover demand. Italian authorities, facing demand for about 12 billion cubic meters in 1969 and an annual growth rate of 10 percent, were seeking supply contracts with foreign producers of natural gas. During 1969 Italy concluded a contract with U.S.S.R. for purchase of 100 billion cubic meters of natural gas during the next 20 years. Deliveries of gas were scheduled to begin in 1973. ENI will take the delivery at the Austrian-Czechoslovakian border near Bratislava.

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From there, by a newly built 200-mile-long pipeline through Austria, the gas will be piped to Tarvisio into the Italian gas system. Italy will pay for the gas by supplying large-diameter pipe, compressors, and other pipeline equipment. Price of the gas delivered at the Italian border will reportedly be 9.42 lire per cubic meter. Discussions with Dutch authorities for deliveries of Dutch gas were reportedly underway during 1969, but no agreement was concluded by yearend. This latest effort to secure Dutch natural gas is considered as a move to find more reliable sources of natural gas than those from the U.S.S.R. and Arabic countries.

Of particular importance for the country's natural gas transmission system was the completion of trunk lines connecting Mestre, Ravenna, and Chieti. These trunk lines connect the Southern and Northern gas distribution grids. In addition, the liquid natural gas (LNG) terminal and regasification plant at Panigaglia (La Spezia) was finished by the end of 1969. In October, the plant received a trial shipment of LNG from Libya.

Petroleum.—During 1969 Italy remained the largest crude oil-processing country in Western Europe. Since domestic production accounted only for about 1.5 percent of the total refinery throughput, Italy depended heavily on imported crude oil, mostly from North Africa and the Middle East.

During 1969 domestic output of petroleum was produced from Sicilian fields at Gela, Ragusa, and Ponte Drillo; from Pisticci in Southern Italy; and from Cortemaggiore in the Po Valley. The downward trend in domestic production of crude oil continued. Future prospects depend upon new discoveries in deep formations in North Italy and the Adriatic Sea.

Thirty-six operating refineries had a total annual capacity of about 130 million tons and additional capacity of 20 million tons was scheduled to go on stream in 1972. Eleven of the 36 refineries accounted for 53 percent of the total capacity:

Owner	Location of the refinery	Approximate distillation capacity (thousand metric tons annually)
Amoco Italia SpA	Cresmona	5,000
ANIC SpA (Azienda Nazionale Idrogenazione Combustibili)	Sannazzaro de' Burgondi	6,100
DOTT Edoardo Garrone, Raffineria Petroli SpA	Genova	7,000
IROM (Industria Raffinazione Oli Minerali) SpA	Porto Marghera	5,300
Mediterranea SpA	Milazzo (Sicily)	8,250
Mobil Oil Italiana SpA	Naples	5,750
RASIOM (Raffinerie Siciliane Oli Minerali)	Augusta (Sicily)	10,800
SARAS, SpA (Societa Anonyma Raffinerie Sarde)	Cagliari (Sardinia)	8,000
SARDOIL, SpA	Porto Torres (Sardinia)	5,000
SARPOM (Societa Anonima Raffineria Padana Oli Minerali)	San Martino di Trecate	7,300
Societa Industriale Catanese (SINCAT)	Priolo	8,000

Four refineries were being expanded with a total capacity of 6,800,000 metric tons, and applications for three new refineries with about 10 million tons of capacity were submitted to the authorities for approval.

The output of refineries was mostly distillate and residual fuel oils.

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The Mineral Industry of Japan

By R. A. Pense [1]

Japan's mineral industry maintained its high world ranking (probably about fourth globally) in 1969 mainly by processing greater amounts of foreign raw materials. In terms of value added by indigenous crude mineral output and by such major processing sectors as steelmaking, nonferrous metal production, and fuels processing, the mineral industry contributed an estimated $7.0 to $7.5 billion to the national economy. This would have constituted about 4 percent of a preliminarily estimated gross national product (GNP) of $167 billion in nominal prices. In both GNP and overall industrial output, Japan ranked third globally in 1969.

Mineral processing, led by iron and steel manufacturing, nonferrous metal production, and fuels treatment, outweighed reported mining by at least 5 to 1 in value. The overall mining production index actually decreased slightly in 1969 while most indexes for mineral processing increased substantially, as shown by the following (1965=100):

	1968	1969
Mining	105.3	104.6
Iron and steel	168.4	202.9
Nonferrous metals	162.9	191.1
Petroleum and coal products	158.3	187.4
Ceramics (including cement and refractories)	144.4	158.8
Chemicals (including chemical fertilizers and petrolchemicals)	153.3	179.5

Productivity gains in mining generally lagged behind the 15 percent increase recorded by all mining and manufacturing in 1969. Efficiency increases in the mineral processing sectors varied in relation to the national industrial mark, with iron and steel showing the greatest improvement. Productivity indexes of the major elements of mining and mineral processing were (1965=100):

	1968	1969
All mining	132.1	148.2
Coal and lignite mining	126.8	142.9
Metal mining	131.1	142.4
Nonmetallic mining	159.0	183.0
Crude petroleum and natural gas production	117.5	133.6
Iron and steel	163.8	197.6
Nonferrous metals	154.9	175.7
Petroleum and coal products	159.6	186.0
Ceramics (including cement and refractories)	139.7	153.4
Chemicals (including chemical fertilizers and petrochemicals)	157.4	182.7

According to a semi-annual business survey conducted in September, investments by major industrial firms in plants and equipment were expected to reach $11.2 billion in fiscal 1969 (April 1969–1970), a 38-percent increase over the previous fiscal year's investments. In the principal mineral-related industries, investments were estimated at approximately $4.3 billion, a planned total increase of 43 percent. Projected investments by sectors of the overall mineral industry in fiscal 1969, in million dollars and with percentage change over the previous fiscal year's outlay, were:

Sector	Investment	Change, percent
Iron and steel	$1,812	+32
Petrochemicals	932	+51
Petroleum refining/marketing	869	+27
Nonferrous metals	397	+38
Cement	223	+33
Chemical fertilizers	159	+57
Coal	78	−7

Among nonferrous metals, investment in aluminum smelting and rolling was to account for almost two-thirds of the outlay.

To meet anticipated strong competition from abroad as trade and investment restrictions were gradually lowered, Japanese industry—with the approval and support of the Government—continued to strengthen its international position through company mergers and capacity increases. By yearend the following minimum capacities had been established in the minerals industry for new plants or

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older facilities where expansion was physically possible: For alumina and primary aluminum plants, 300,000 and 100,000 metric tons per year, respectively; for petroleum refineries, 200,000 barrels per stream day; for ammonia, 1,000 tons per stream day; and for ethylene, 300,000 tons annually. In copper refining, while no definite standard appears to have been set, where possible, most companies were building individual facilities up to 10,000 ingot tons per month. No Government encouragement was necessary in the ordinary steel industry, where plants were generally being programmed to reach the 10- to 12-million-ton-per-year crude steel level. In the ferroalloy sector, however, only slow progress was being made in rationalizing company strengths and scales despite strong Government intervention.

Detailed geological exploration for "kuroku" (black) ore reserves was carried out in four parts of northern Honshu during the year. In July the Metallic Minerals Exploration Agency, the Government's principal organ in domestic metals development, contacted during drilling a "kuroku" ore body at 200-meter-depth in western Fukushima Prefecture. Later, two mining companies drilling nearby intersected at 200 to 300 meters what was believed to be the same body. This latest discovery seemed to confirm the presence of significant "kuroku" bodies outside of Akita Prefecture, where until now their exploitation has been largely confined.

Development of Japan's offshore minerals was advanced significantly. Late in 1969 the Ministry of International Trade and Industry (MITI) introduced new legislation into the Diet, defining the Japanese Continental Shelf and the Government's authority over it more clearly. Under the draft version of the Bill entitled "Promotion of Mineral Resources Development in the Continental Shelf," the existing Mining Act of 1950 which presently governs offshore mining operations will be partly superceded. The Continental Shelf is to be generally considered as extending beyond territorial waters to at least a depth of 200 meters. Within this area (estimated up to 280,000 square kilometers), MITI permission will continue to have to be obtained for both exploration and exploitation. Exploration rights are in effect for 2 years, but drilling is to be started within 1 year. Exploitation rights must be exercised within 3 years. MITI retains the right to expedite or rationalize mineral resources development by transferring mining rights from one party to another. Size limitations for offshore mining grants have not yet been decided.

Petroleum and natural gas are specifically identified as the principal mineral resources covered by the new legislation. These are to be developed in accordance with plans put forward by MITI from recommendations of the Petroleum and Inflammable Natural Gas Resources Development Council (PINGRDC). Financial assistance is to be provided in part by the Japan Petroleum Development Council, whose present authority is limited to assisting overseas ventures. In July PINGRDC recommended to MITI that $67.7 million be expended by the Government over the 5 years beginning April 1970 in offshore petroleum development. At least $11 million was to be spent in basic (aeromagnetic, seismic, and gravimetric) surveys conducted mainly in the sea of Japan. Most of the remaining funding was for the drilling of up to 32 exploratory wells. With the total investment, PINGRDC estimated that up to 75 million barrels of reserves might be discovered within the 100-meter-depth mark, believed to be the present limit of commercial operations. MITI in turn requested an initial $1 million for survey work in fiscal year 1970 (April 1970–March 1971.).

In related offshore minerals development activity the Council for Marine Science and Technology, an advisory body to the Prime Minister, recommended in July a medium-range (5-year) ocean resources exploitation program which included development of remote-controlled equipment capable of recovering petroleum at depths of 200 to 250 meters. Both MITI and the Science and Technology Agency announced formation in July of Bureaus of Offshore Development. MITI's Bureau is to coordinate the research, information gathering, and mineral development projects conducted by private concerns on the Continental Shelf, and the agency's Bureau is to coordinate the offshore activities of all Ministries including MITI. Early in 1969 Sumitomo Trading Co., Ltd., had joined with Ocean Systems, Inc., of the United States to form Japan Ocean Industries. The new concern is to offer offshore petroleum exploration services to Japanese en-

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terprises. This was the third Japanese-U.S. venture formed during the last 2 years for virtually the same purpose.

In support of the Basic Law on Public Hazards Countermeasures of 1967 and the Anti-Air Pollution Law of 1968, specific standards were established by administrative action in February for sulfur dioxide emissions. Industrially developed areas were to be allowed up to 10 years to reduce discharges to the maximum permissible levels, and industrially developing zones, up to 5 years; immediate compliance was expected from other areas where industrial development is as yet only in a planning stage. Government assistance was to be given in the exploration, development, and import of low-sulfur crude oil and of natural gas, and also in the development and application of fuel oil and fuel gas desulfurization technology.

Japanese interest in developing the mineral resources of Siberia and of Alaska took differrent courses in 1969. By yearend protracted negotiations with the Soviet Union over joint exploitation of the Udokan copper deposit near Lake Baikal and natural gas resources of Sakhalin Island had virutally broken down over issues of cost and price. In Alaska, however, Japan Gas-Chemical Co., Inc., and Collier Carbon Chemical Corp. jointly completed a 1,000-ton-per-day urea fertilizer plant on the Kenai Peninsula, while Tokyo Gas Co., Ltd., and Tokyo Electric Power, Inc., in November took the first deliveries of liquefied natural gas under a 15-year, estimated 170-million-barrel contract with two U.S. concerns, which had completed a liquefaction plant on Kenai. Alasko U.S.A., Ltd., a wholly owned U.S. subsidiary of Japan's Alaska Petroleum Development Co., Ltd., spent an estimated $4.3 million in fiscal year 1969 in drilling wells in the Cook Inlet and Bristol Bay areas. Marubeni-Iida Co., Ltd., tentatively agreed with the Marcona Corp. to jointly develop an iron ore deposit on the Snettisham Peninsula. From 2 to 4 million tons of pellets annually may eventually be exported to Japan.

Late in October the Fair Trade Commission after some 5 months of hearings overturned its previous (early May) negative decision and conditionally approved the merger of Japan's two largest steel companies—Yawate Iron and Steel Co., Ltd. and Fuji Iron and Steel Co., Ltd. By yearend the two firms had essentially met all of the Commission's stipulations aimed at preventing the new company from exercising an oligarchical position in the production of four steel products.

Actual consolidation was scheduled for March 31, 1970, some 24 months after intentions of the merger first were announced. By the date of formation, the new concern, to be titled Nippon Steel Corp., is expected to be the largest private steel producer in the world. Crude steel capacity in seven or eight integrated plants at that time is expected to be 31 million tons annually, somewhat in excess of that of United States Steel Corp. Capitalization is set at $637 million and the working force at about 80,000. During fiscal 1970 capacity is planned to increase to 35 million tons, and total production to 30 million tons or roughly 35 percent of national output. Among the anticipated results of the merger are increased steel price stability, more control over exports, and probably a slower industry growth through reduced investments in new facilities.

PRODUCTION

The value of mineral industry output in 1969 was estimated at $7.0 to $7.5 billion. The corresponding estimate for 1968 was $7.0 billion. Total output values and added values of the major sectors of mining and of selected crude minerals in 1968, the most recent year for which official Japanese data are available, were as follow:

Sector	Output value (million dollars)	Added value (million dollars)
Coal and lignite mining	467	315
Metal mining, including pyrites:	251	173
Copper	147	99
Lead and zinc	46	32
Nonmetal mining:	186	126
Limestone	88	63
Crude oil and natural gas production	49	34
All crude mineral commodities	953	648

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Largely excluded from the official mine output data but included in U.S. Bureau of Mines estimates is the very substantial value of stone and sand and gravel for construction use.

Preliminary official Japanese data for the value added in 1968 by some of the important mineral processing sectors showed $2,684 million by the iron and steel industry; $1,042 million by the nonferrous metal processing industry; and $491 million by the fuels processing industry.

Included in Bureau of Mines estimates for total mineral industry output value, but not available from official Japanese data for comparable dates, are considerable added values contributed by chemical fertilizers, petrochemicals, cement, and refractories.

Only the United States and the U.S.S.R. exceeded Japan in the production of pig iron, ferroalloys, crude steel, and special steels in 1969. In the smelting and refining of the major nonferrous metals it placed approximately as follows: Aluminum (4th); copper (5th); lead (6th); and zinc (3rd). In mine production of metals, the country ranked somewhat less highly, although holding a position among the top 10 world producers of copper and zinc.

Japan again led the world in producing pyrites and talc-soapstone-pyrophyllite and remained the third largest producer of cement. The country evidently became the third largest petroleum refiner during the year, surpassing Italy, but remained the fourth largest coke producer, after West Germany. The petrochemical industry, including the important nitrogenous and phosphatic fertilizer producing sectors, claimed to be second only to that of the United States. Burgeoning production of ammonia and ethylene was principally responsible for the enhanced status of this industry.

Table 1.—Japan: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity		1967	1968	1969
METALS				
Aluminum:				
Alumina, gross weight		748	826	1,064
Metal:				
Primary		382	482	569
Secondary		r 181	227	279
Antimony:				
Mine output, metal content	tons	17	19	5
Metal	do	2,703	2,678	3,497
Arsenic, white	do	643	r 716	718
Bismuth, metal	do	634	724	695
Cadmium, metal	do	1,899	2,195	2,765
Chromium:				
Chromite		45	r 28	30
Metal	tons	1,325	1,212	1,205
Columbium and tantalum, metal, tantalum	do	12	11	15
Copper:				
Mine output, metal content		118	120	120
Metal, refined:				
Primary		470	548	629
Secondary		148	176	190
Germanium:				
Oxide recovered	tons	23	24	NA
Metal	do	21	r 22	27
Gold:				
Mine output, metal content	thousand troy ounces	253	239	253
Metal	do	678	r 614	677
Indium, metal	do	561	r 565	553
Iron and steel:				
Iron ore and concentrate		2,213	2,171	1,855
Roasted pyrite		2,033	r 1,968	1,920
Pig iron		40,095	46,397	58,147
Ferroalloys:				
Ferrochrome		197	214	259
Ferromanganese		303	344	382
Ferronickel		107	134	180
Ferrosilicon		146	167	225
Silicomanganese		176	190	230
Other [1]		5	5	6
Steel, ingots and castings		62,154	66,892	82,948
Steel semimanufactures, hot rolled:				
Ordinary		45,934	50,509	60,483
Special		4,426	5,178	6,577

See footnotes at end of table.

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Table 1.—Japan: Production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity		1967	1968	1969
METALS—Continued				
Lead:				
Mine output, metal content		63	63	64
Metal:				
Primary		150	165	187
Secondary		36	42	48
Magnesium, metal, primary	tons	6,748	5,657	9,382
Manganese:				
Ore and concentrate, gross weight		339	r 312	302
Metal	tons	6,333	7,086	7,218
Mercury:				
Mine output, metal content	76-pound flasks	4,616	r 5,084	5,599
Metal, primary	do	8,690	r 7,676	6,548
Molybdenum:				
Mine output, metal content	tons	256	r 282	269
Metal	do	204	202	297
Nickel, metal, primary	do	7,407	r 9,586	10,241
Platinum-group metals, metal:				
Palladium	troy ounces	3,327	r 3,651	3,877
Platinum	do	3,072	r 2,785	3,140
Rare-earth metals, cerium	tons	90	74	116
Selenium, elemental	do	191	181	197
Silver:				
Mine output, metal content	thousand troy ounces	10,800	r 10,698	10,804
Metal, primary	do	22,173	27,874	27,898
Tellurium, elemental	tons	13	14	28
Tin:				
Mine output, metal content	long tons	1,166	r 930	729
Metal, primary	do	1,666	r 1,861	1,877
Titanium, metal	tons	7,840	5,428	6,444
Tungsten:				
Mine output, metal content	do	391	r 584	607
Metal		1,004	1,141	1,389
Zinc:				
Mine output, metal content		263	264	270
Metal, primary		516	606	712
Zirconium, metal	kilograms	33	39	55
NONMETALS				
Asbestos		25	22	21
Barite		38	r 59	62
Bromine, elemental	tons	6,002	6,330	7,118
Cement, hydraulic		42,993	48,009	51,386
Clays:				
Fire clay		1,420	1,964	2,217
Kaolin		150	r 170	189
Feldspar (including feldspar substitutes)		372	r 422	495
Fertilizer materials:				
Crude, potash, gross weight		12	15	19
Manufactured:				
Nitrogenous, nitrogen content e		1,885	2,000	NA
Superphosphates		1,195	1,147	980
Fluorspar, all grades		15	r 13	12
Graphite (crystalline)	tons	1,715	1,489	1,726
Gypsum		584	562	560
Iodine, elemental	tons	2,910	3,591	4,619
Lime (quicklime)		3,082	3,625	4,225
Pigments, natural mineral:				
Antimony oxide	tons	1,861	2,142	2,963
Manganese oxide		34	32	38
Titanium slag	tons	5,709	4,195	5,096
Zinc oxide		42	52	56
Pyrite, pyrrhotite (including cupreous), gross weight		4,528	r 4,472	4,453
Salt, all types		973	967	981
Stone, sand and gravel, n.e.s.:				
Crushed and broken:				
Dolomite		2,144	r 2,221	2,352
Limestone		81,719	r 91,528	103,181
Stone, not further described (silica stone)		4,075	r 5,333	6,305
Sand (including glass sand)		3,332	r 3,689	3,804
Sulfur, elemental:				
Native, other than Frasch		254	260	204
Byproduct (recovered from petroleum refining)		62	r 76	142
Sulfuric acid		6,280	6,591	6,760
Talc and related materials:				
Pyrophyllite		1,250	1,545	1,554
Talc		130	r 149	152

See footnotes at end of table.

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Table 1.—Japan: Production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity		1967	1968	1969
MINERAL FUELS AND RELATED MATERIALS				
Carbon black		176	219	261
Coal:				
Anthracite		1,514	1,489	1,225
Bituminous [3]		45,532	45,079	43,162
Lignite		366	335	251
Coke:				
Metallurgical		22,171	r 26,136	31,013
Gashouse		4,165	4,470	5,009
Fuel briquets, all grades		3,839	3,802	3,241
Gas:				
Natural:				
Gross production [3]	million cubic feet	66,784	72,617	77,890
Marketed	do.	65,634	71,077	76,173
Natural gas liquids:				
Natural gasoline	thousand 42-gallon barrels	28	33	35
Liquefied natural gas	do.	654	559	NA
Liquefied petroleum gas (from natural gas):				
From field plants	do.	142	138	127
From petrochemical plants	do.	18,545	24,861	33,338
Peat e		70	70	70
Petroleum:				
Crude oil	thousand 42-gallon barrels	5,520	5,476	5,502
Refinery products:				
Gasoline, aviation and motor	do.	90,806	103,121	116,241
Naphtha	do.	67,649	87,983	107,864
Kerosine	do.	54,394	65,919	81,216
Jet fuel	do.	15,340	18,726	21,061
Distillate fuel oils	do.	81,450	97,630	115,714
Residual fuel oil	do.	382,061	429,481	515,072
Liquefied petroleum gas	do.	26,548	30,134	33,398
Lubricating oils	do.	9,348	10,690	12,485
Greases	do.	297	322	364
Asphalt and bitumen, refinery	do.	12,507	15,114	17,511
Petroleum coke	do.	396	448	462
Paraffin	do.	693	787	917
Refinery fuel [4]	do.	17,554	r 21,799	e 26,000

e Estimate. r Revised. NA Not available.
[1] Includes ferromolybdenum, ferrotungsten, and ferrovanadium.
[2] Includes small amount of natural coke.
[3] Includes small amount of coal mine gas.
[4] Excludes natural and refinery gas.

TRADE

Total commodity trade amounted to $31,014 million in 1969, with exports of $15,990 million (up 23 percent) and imports of $15,024 million (up 16 percent) again representing new highs. Mineral trade roughly kept pace with the overall expansion: Mineral exports accounted for approximately one-sixth of all exports and mineral imports for somewhat over two-fifths of all imports. While exports of mineral products—as conventionally classified—fell far short of mineral imports, shipments abroad of manufactured metallic products such as ships, automobiles, and industrial machinery helped somewhat to offset the deficit. The key iron and steel industry showed a favorable balance for the second consecutive year on the basis of exports of primary and semimanufactured products weighed against its imports of mineral raw materials as inputs.

By far the most important mineral exports were iron and steel products, valued at $2,165 million in official trade data. Nonferrous metals ($186 million), fertilizers ($137 million) and nonmetallic mineral manufactures ($168 million including $30 million of cement) accounted for most of the remainder.

The most significant mineral imports were mineral fuels and lubricants valued at $3,044 million. Of this total, crude and partly refined oil accounted for $1,907 million, petroleum products $392 million, and coking coal $651 million. Approximately $1,972 million of metalliferous ores and scrap, including $969 million of iron ore, $209 million of iron and steel scrap, and $354 million of copper concentrates, were imported. Imports of nonferrous metals and alloys, the third major category of mineral imports, amounted to $917 mil-

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lion, of which $508 million was copper and alloys and $169 million aluminum and alloys.

The United States was Japan's largest trading partner in both overall and mineral commodity trade. It accounted for 31 percent and 27 percent, respectively, of all commodity exports and imports. In mineral trade the United States received a somewhat higher proportion of Japan's exports, probably about 40 percent, and provided considerably less of its imports, an estimated 15 percent. Iron and steel products, unofficially valued at $833 million, constituted an estimated 95 percent of the Japanese mineral commodities exported to the United States. The most important of the wide variety of minerals imported from the United States were coking coal ($364 million) and iron and steel scrap ($159 million).

Table 2.—Japan: Exports of mineral commodities [1]

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969	Principal destinations, 1968
METALS				
Aluminum:				
Oxide and hydroxide	89	29	113	United States 10; Thailand 5.
Metal, including alloys, all forms	21	35	45	United States 18; South Vietnam 5.
Bismuth, metal, including alloys, all forms tons	r 270	r 391	261	Netherlands 182; France 80.
Cadmium, metal, including alloys, all forms tons	565	708	772	Netherlands 276; United States 236.
Copper, metal, including alloys, all forms	34	43	53	United States 18, Hong Kong 7.
Iron and steel metal:				
Ferroalloys:				
Ferromanganese	5	7	11	United States 3; Australia 1.
Others	10	12	12	United States 7.
Steel, primary forms	810	1,249	1,934	United States 778; South Korea 80.
Semimanufactures:				
Wire rod	659	854	1,079	United States 535; Thailand 164.
Other rods and bars	r 319	r 537	683	United States 286; mainland China 135.
Angles, shapes and sections	378	556	650	United States 336.
Universals and heavy plates, uncoated	763	1,357	1,745	United States 822.
Medium plates and sheets, uncoated	409	559	631	United States 379.
Light plates and sheets, uncoated	r 2,431	r 3,597	4,348	United States 1,747.
Tinned plates and sheets	407	487	549	United States 133; mainland China 78.
Other coated plates and sheets	632	860	1,020	United States 513.
Hoop and strip	209	254	376	United States 67; Thailand 38.
Wire	342	403	460	United States 256.
Tubes, pipes and fittings	1,390	1,978	2,261	United States 804; mainland China 276.
Other	57	56	55	South Korea 38.
Lead, metal, including alloys	8	5	3	Taiwan 2.
Manganese, oxides	24	27	31	United Kingdom 3.
Mercury 76-pound flasks	864	486	1,096	South Korea 241; North Korea 200.
Phosphorus, elemental (red) tons	570	527	645	United States 284; India 115.
Platinum-group metals, metal, including alloys, all forms thousand troy ounces	26	132	61	United States 89.
Selenium, elemental tons	48	51	28	United States 21; United Kingdom 11.
Silver, metal, including alloys thousand troy ounces	164	710	1,489	United States 351; Taiwan 261.
Titanium:				
Oxides (rutile and others)	28	35	42	United States 14.
Metal, including alloys, all forms tons	4,982	3,469	4,695	United States 2,727.
Zinc, metal, including alloys, all forms	69	90	100	United States 40; Philippines 9; India 7.
NONMETALS				
Abrasives, dust and powder of diamond thousand carats	2,771	760	824	United States 597.
Cement	2,076	1,907	2,134	Kuwait 332; Ryukyu 227; Singapore 220.
Diamond:				
Gem, not set or strung thousand carats	648	8	---	Ryukyu 3.
Industrial do	482	77	118	United Kingdom 27; South Korea 26.

See footnotes at end of table.

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Table 2.—Japan: Exports of mineral commodities [1]—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969	Principal destinations, 1968
NONMETALS—Continued				
Diatomite and other infusorial earths tons	657	778	2,007	Malaysia 359.
Fertilizer materials: Manufactured:				
Nitrogenous [2]	r 1,722	r 1,614	1,112	Mainland China 774; South Korea 268.
Other	196	222	233	Thailand 98; Ryukyu 27.
Gypsum and plasters	11	14	17	Singapore 6; South Vietnam 5.
Iodine tons	2,123	3,003	3,581	United States 1,450; West Germany 383.
Magnesite	17	11	---	United States 5; Australia 3.
Precious and semiprecious stone, except diamond thousand carats	r 77,780	r 57,521	102,395	United States 24,193; Hong Kong 20,312.
Sodium and potassium compounds, n.e.s.	84	128	214	Australia 88; U.S.S.R. 22.
Stone, sand and gravel, limestone (except dimension)	369	702	828	Australia 442; Hong Kong 253.
Sulfur:				
Elemental, all forms	2	13	29	Taiwan 10.
Sulfuric acid	1	2	2	Hong Kong 1.
Other nonmetals, n.e.s.: Oxides and hydroxides of magnesium, strontium, and barium	19	22	---	Australia 18.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	13	16	16	Taiwan 4; mainland China 3.
Coal, all grades, including briquets	59	32	28	South Korea 17; Hong Kong 9.
Coke	46	65	84	South Korea 47.
Petroleum: Refinery products:				
Nonbunker:				
Gasoline thousand 42-gallon barrels	2,258	1,062	562	Ryukyu 568; Guam 197.
Naphtha do	534	69	135	South Korea 30; Ryukyu 23.
Kerosine and jet fuel oil do	2,380	1,515	4,361	Ryukyu 692; Hong Kong 363.
Fuel oil do	2,308	893	601	Hong Kong 551; Ryukyu 141.
Lubricants do	r 630	r 1,106	1,624	South Korea 865; Taiwan 260; Singapore 219.
Asphalt do	602	788	1,201	Indonesia 856; Thailand 214.
Other do	r 522	r 576	908	Ryukyu 133; South Korea 107.
Bunker: [3]				
Kerosine and jet fuel do	5,308	6,451	NA	NA.
Distillate fuel oil do	6,465	7,058	NA	NA.
Residual fuel oil do	r 78,545	78,878	NA	NA.
Other do	130	162	NA	NA.

r Revised. NA Not available.

[1] Excludes exports under Japanese-United States Mutual Defense Agreement or for account of U.S. military forces.

[2] Excludes exports of following amounts of urea containing more than 45 percent nitrogen: 1967, 1,272,472 tons; 1968, 1,443,736 tons; and 1969, 1,400,601 tons.

[3] From supplementary trade data.

Source: Japan Ministry of Finance. Japan Exports and Imports, Commodity by Country, 1967–69.

Table 3.—Japan: Imports of mineral commodities [1]

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969	Principal sources, 1968
METALS				
Aluminum:				
Bauxite and concentrate	2,086	2,450	3,122	Australia 915; Indonesia 757; Malaysia 687.
Oxide and hydroxide	120	180	223	Australia 176.
Metal, including alloys:				
Scrap	21	24	19	United States 14.
Unwrought	165	169	319	Canada 85; Ghana 22; United States 22.
Antimony:				
Ore and concentrate tons	9,070	8,074	12,657	Bolivia 5,877; mainland China 1,290.
Metal, including alloys, all forms tons	890	68	5	U.S.S.R. 63.
Arsenic, oxides and acids do	2,044	r 3,419	2,638	France 2,299.
Chromium, chromite	596	636	733	Republic of South Africa 179; U.S.S.R. 168; Philippines 130; India 116.

See footnotes at end of table.

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Table 3.—Japan: Imports of mineral commodities [1]—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969	Principal sources, 1968
METALS—Continued				
Copper:				
Ore and concentrate	1,022	1,061	1,120	Philippines 417; Canada 385.
Matte	25	24	31	Chile 14.
Metal, including alloys:				
Scrap	77	58	50	United States 29; Canada 9.
Unwrought	270	292	349	Zambia 141; Chile 37; Republic of South Africa 26.
Iron and steel:				
Ore and concentrate	56,696	68,164	83,089	Australia 13,814; India 12,630; Chile 8,707; Peru 7,363.
Metal:				
Scrap	6,708	3,948	4,878	United States 2,933.
Pig iron, including cast iron	6,450	4,456	3,577	India 756; Republic of South Africa 742; U.S.S.R. 656; East Germany 543.
Sponge iron, powder and shot	36	42	46	North Korea 31.
Ferroalloys	71	63	85	Norway 23; Republic of South Africa 18; Canada 10.
Steel, primary forms and semi-manufactures	396	120	144	Australia 42; North Korea 27; India 17.
Lead:				
Ore and concentrate	130	144	180	Canada 50; Peru 40; Australia 27.
Metal, including alloys, all forms	21	r 12	8	United States 4; Canada 3.
Magnesium, metal, including alloys, all forms—tons	841	r 443	102	U.S.S.R. 355.
Manganese, ore and concentrate [2]	1,507	1,751	2,025	India 618; Republic of South Africa 368; Australia 294.
Mercury—76-pound flasks	32,083	26,062	25,573	Italy 6,379; Spain 5,108; Mexico 5,027.
Molybdenum, ore and concentrate—tons	8,787	9,539	12,237	United States 3,929; Canada 3,392.
Nickel:				
Ore and concentrate	1,661	2,712	3,395	New Caledonia 2,418; Indonesia 235.
Matte, speiss, and similar materials	10	13	17	Canada 7; New Caledonia 6.
Metal, including alloys, all forms—tons	14,332	5,293	8,327	U.S.S.R. 1,522; Canada 1,314.
Platinum-group metals: Metal, including alloys:				
Platinum—thousand troy ounces	234	214	278	U.S.S.R. 97, United Kingdom 64.
Paladium—do	354	600	492	U.S.S.R. 535.
Silver, metal, including alloys—do	10,170	12,807	10,460	Peru 4,147; Australia 3,695.
Tin:				
Ore and concentrate—long tons	594	1,102	22	Australia 1,079.
Metal, including alloys, all forms—do	19,306	20,261	31,438	Malaysia 18,049.
Titanium:				
Ore and concentrate	274	364	410	Malaysia 121; Australia 97; Ceylon 74.
Oxides [3]—tons	5,356	r 5,694	4,192	France 2,437; United Kingdom 1,623; Australia 1,330.
Tungsten, ore and concentrate—do	4,507	2,881	4,865	South Korea 1,158; Thailand 484; Peru 414.
Zinc:				
Ore and concentrate	614	857	847	Peru 387; Mexico 191; Australia 112.
Metal, including alloys, all forms	18	9	8	North Korea 4; Canada 4.
NONMETALS				
Abrasives, natural, n.e.s.—tons	4,225	r 5,889	7,523	United States 2,763; Italy 2,188.
Asbestos	189	199	237	Canada 105; Republic of South Africa 65.
Barite and witherite	34	6	29	Mainland China 6.
Boron materials:				
Crude natural borates	8	12	22	Turkey 9; United States 3.
Oxide and acid	8	11	14	United States 10.
Clay and clay products:				
Crude clay, n.e.s.:				
Kaolin	104	124	137	United States 70; South Korea 40.
Kyanite and sillimanite	31	31	35	Republic of South Africa 21; India 8.
Other	155	r 220	230	United States 72; Republic of South Africa 58; mainland China 53.
Cryolite and chiolite	9	8	9	Denmark 8.

See footnotes at end of table.

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Table 3.—Japan: Imports of mineral commodities [1]—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969	Principal sources, 1968
NONMETALS—Continued				
Diamond:				
Gem, not set or strung, thousand carats	512	324	591	Israel 88; Belgium 76; Hong Kong 72.
Industrial:				
Stones, do	734	753	651	United Kingdom 260; Belgium 210; United States 144.
Dust and powder, do	2,861	3,499	4,936	United States 2,122; United Kingdom 725.
Fertilizer materials:				
Crude, phosphatic	2,632	3,417	2,964	United States 2,519; Morocco 464.
Manufactured, potassic	r 1,216	r 1,318	1,361	Canada 489; United States 370; U.S.S.R. 206.
Fluorspar	359	494	522	Thailand 193; mainland China 111; Republic of South Africa 76.
Graphite, natural	55	63	58	South Korea 43; North Korea 13.
Gypsum and plasters	44	57	61	Morocco 52.
Magnesite	35	25	27	North Korea 13; mainland China 7.
Mica, all forms	8	18	7	Republic of South Africa 10.
Pyrite (gross weight)	79	---	55	
Salt (excluding brines)	4,432	5,023	5,657	Mexico 2,143; mainland China 719; India 515.
Stone, sand and gravel: Quartz and quartzite	128	97	152	South Korea 82.
Talc, steatite, soapstone, pyrophyllite	95	127	185	Mainland China 57; South Korea 38.
Other nonmetals, n.e.s., slag, dross, and similar waste, not metal bearing	118	182	157	India 114; South Korea 33.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	4	5	3	United States 5.
Coal and briquets:				
Anthracite	1,436	1,457	1,301	Republic of South Africa 378; North Vietnam 284; South Korea 203.
Bituminous:				
Heavy coking coal, less than 8 percent ash	12,900	16,958	19,794	United States 13,259; Australia 2,224.
Heavy coking coal, more than 8 percent ash	6,601	6,817	10,417	Australia 4,381; U.S.S.R. 1,387.
Other coking coal	4,350	7,193	9,650	Australia 5,380.
Lignite and lignite briquets	21	15	26	Australia 15.
Coke and semicoke	223	235	173	Australia 78; United States 56; Czechoslovakia 45.
Gas, hydrocarbon (liquefied natural gas), thousand 42-gallon barrels	---	---	620	
Petroleum:				
Crude and partly refined:				
Crude, thousand 42-gallon barrels	696,838	780,206	963,360	Iran 324,644; Saudi Arabia 112,203; Kuwait 110,272.
Partly refined, do	61,872	99,290	89,613	Saudi Arabia 53,869; Kuwait-Saudi Arabia Neutral Zone 30,518.
Refinery products:				
Naphtha, do	10,504	19,863	28,317	Kuwait 6,510; Saudi Arabia 5,930.
Kerosine and jet fuel, do	320	1,120	1,541	Singapore 700.
Distillate fuel oil, do	17,869	18,781	12,007	U.S.S.R. 3,458; Kuwait 1,611; Netherlands 1,109.
Residual fuel oil, do	71,742	90,925	96,598	Singapore 15,843; Kuwait 14,334; Indonesia 11,639.
Lubricants, do	r 4,688	r 3,307	3,303	United States 2,814.
Liquefied petroleum gas, do	14,024	20,219	25,944	Kuwait 10,975; Saudi Arabia 7,375.
Petroleum coke, do	7,150	9,652	9,472	United States 8,635.
Other, do	r 611	r 852	1,037	United States 716.

r Revised.

[1] Excludes imports under Japanese—United States Mutual Defense Agreement or for account of U.S. military forces.

[2] Includes ferruginous manganese and manganese dioxide.

[3] Includes titanium slag.

Source: Japan Ministry of Finance. Japan Exports and Imports, Commodity by Country 1967–69.

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COMMODITY REVIEW

METALS

Aluminum.—While production of primary aluminum registered another substantial gain in 1969, it was still grossly short of meeting domestic demand estimated at 800,000 metric tons. Japan remained the world's fourth largest producer and third largest consumer of primary aluminum. To supplement the foreign bauxite upon which producers are heavily dependent for raw material, significant quantities of alumina and unwrought aluminum and alloys also had to be imported. Almost one-half of the bauxite and all of the alumina was provided by Australia, while Canada and the United States provided nearly three-quarters of the unwrought metal. Exports of semimanufactures were of some assistance in offsetting expenditures for raw materials imports.

Alumina and primary aluminum producing facilities were believed to be as follows at yearend:

Company and facility	Annual capacity (thousand metric tons)	
	Alumina	Aluminum
Mitsubishi Chemical Industries, Ltd.		
Naoetsu	---	112
Nippon Light Metal Co., Ltd.		
Kambara	---	109
Niigata	---	59
Shimizu	456	---
Tomakomai	---	58
Showa Denko Co., Ltd.		
Chiba	---	88
Kitakata	---	48
Omachi	---	48
Yokohama	840	---
Sumitomo Chemical Co., Ltd.		
Kikumoto	400	80
Nagoya	---	50
Niihama	---	79
Total	1,196	666

The principal addition to reduction capacity during the year was Nippon Light Metal's new 58,000-ton-per-year Tomakomai plant on Kokkaido which started up in November well ahead of original plans. Until an adjacent alumina plant is completed in 1972, foreign alumina is to be purchased for input material. Other major new primary capacity under construction in 1969 for completion in 1970 included Showa Denko's new 80,000-ton plant at Chiba in central Honshu; Sumitomo Chemical's new 58,000-ton facility at Toyama in north-central Honshu; and Mitsubishi Chemical's 45,000-ton expansion of its existing Naoetsu plant in north-central Honshu. Mitsui Aluminum Industry Co., Ltd., a new producer, was to bring on stream its first plant, a 38,000-ton refinery, at Omuta on Kyushu. Imported alumina is to be processed until a nearby alumina plant can be completed in 1972.

Overseas, Sumitomo Chemical and Showa Denko, already participants in a reduction plant under construction in New Zealand, requested that the planned 107,000-ton-per-year capacity be doubled. The same two concerns also agreed tentatively to become 25-percent-each partners in a 1.2-million-ton-per-year alumina plant to be built at Kimberly in northwestern Australia.

Copper.—Domestic primary ingot production rose to another new high in 1969, holding the country's position as the fifth largest copper refiner in the world. Despite increasing output of copper-bearing "kuroku" ore domestic production of mine copper remained virtually stationary for the third straight year. As a consequence, more than twice as much foreign copper in ores and concentrates was imported, with the Philippines and Canada together providing slightly more than three-quarters of the total. Large amounts of unwrought copper, including blister copper (to supplement the indigenous blister output of 501,000 tons) and refined copper, also had to be imported to satisfy domestic needs. Zambia was the largest single supplier of blister copper and accounted for two-thirds of the refined copper. Because of a temporary supply-demand imbalance, the extraordinary export of 10,000 tons of refined copper was authorized by MITI in the last half of 1969.

To help secure the estimated 950,000 tons of new foreign copper now projected as necessary to meet demand in 1975, Japanese copper companies in 1969 effectively concluded with overseas ore producers the following important 10- to 15-year agreements scheduled to begin in 1971: With Atlas Consolidated Mining and Development Corporation in the Philippines for an additional 30,000 tons of mine copper per year from its Toledo workings on Cebu; with Compañiá Minera Andina S.A. in Chile for 44,000 tons of copper-in-concentrates yearly from its Rio Blanco de-

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posit; and with Utah Construction & Mining Co. of the United States for 45,000 to 50,000 tons of contained copper annually from its Vancouver Island property in British Columbia, Canada. Other major agreements reached involved the acquisition of at least 50,000 tons of mine copper per year for 12 years starting in 1972 from the Highland Valley deposit of Lornex Mining Corp. in British Columbia; about 95,000 tons of copper-in-concentrate yearly for at least 10 years commencing in 1972 from the Bougainville property of Bougainville Copper Pty., Ltd., in the Solomon Islands; and at least 40,000 tons of contained copper annually beginning in 1973 from the Ertsberg deposit of Freeport Indonesia, Incorporated, in West Irian.

Smelting and refining facilities of the copper industry were believed to be as follows at yearend:

Company and facility	Annual capacity (thousand metric tons)	
	Smelting	Refining
Dowa Mining Co., Ltd.		
Kosaka	40	40
Okayama	12	18
Furukawa Mining Co., Ltd.		
Ashio	38	---
Furukawa Electric Co., Ltd.		
Nikko	---	36
Mitsubishi Metal Mining Co., Ltd.		
Naoshima	84	84
Osaka	---	84
Mitsui Mining and Smelting Co., Ltd.		
Hibi	44	---
Takehara	---	76
Nippon Mining Co., Ltd.		
Hitachi	60	60
Saganoseki	96	96
Onahama Smelting and Refining Co., Ltd.		
Onahama	90	120
Sumitomo Metal Mining Co., Ltd.		
Kunitomi	16	---
Niihama	72	120
Toho Zinc Co., Ltd.		
Onahama	14	14
Total	566	748

Because of alleged weaknesses in competing with the better supplied Nippon Mining and Sumitomo Metal Mining companies for foreign concentrates, Dowa, Mitsubishi Metal, and Mitsui Smelting announced plans to coordinate their overseas acquisition activities. Additional cooperation in the area of smelting and refining operations was also mentioned as a possibility. While small amounts of stock were consequently exchanged among the three companies, outright merger is not considered likely.

Efforts continued during the year to form a copper stabilization agency to protect Japanese copper miners, processors and consumers against fluctuating world market prices. As now envisaged, the agency would be engaged principally in buying and selling copper on the London Metal Exchange. While neither the exact composition of the organization nor the source of all the extensive funding needed have yet been determined, MITI was lending its guidance and assistance in the project.

Ferroalloys.—In January, Japan Heavy Chemicals Industry Co., Ltd., was formed by Azuma Kako Co., Ltd., and Nippon Ferroalloys Co., Ltd., both affiliates of Yawata Iron and Steel Co., Ltd. Capitalized at $8.3 million, the new company had 2,500 employees and an estimated 30 percent share of the ferroalloys market. Reportedly, total ferroalloy producing capacity was 450,000 tons annually in five scattered plants at Oguni, Matsukawa, and Sakata in northern Honshu and Fushiki and Nomachi in north-central Honshu. In May the new company announced it would build a 70,000-ton-per-year high-carbon ferrochromium plant somewhere on Kyushu.

Supply of ferrosilicon continued tight throughout 1969, spurring increases in production capacity in this specialized field. Nippon Carbide Industries Co., Ltd. began near midyear to produce ferrosilicon at a rate of 6,000 tons annually from a 15,000-kva furnace at its Uozu plant in north-central Honshu; a 5,500-kva furnace also was to start producing ferrosilicon there before yearend. Other significant furnace additions scheduled for completion during the year included Kureha Chemical Industry Co., Ltd.'s 36,000-kva unit at its Toyama plant, Toyo Electrochemical Co., Ltd.'s 15,000-kva furnace at its Kochi plant on Shikoku, a 15,000-kva furnace by Ube Industries Ltd., and a 10,000-kva furnace by Joetsu Electric Furnace Co., Ltd.

Nippon Electrical Industry Co., Ltd., completed in December a 36,000-kva furnace at a 100,000-ton-per-year ferromanganese plant it was building at Anan on Shikoku. Nippon Steel Tube Co., Ltd., began construction near yearend of a large new electric furnace at its ferrosilicon and silicochromium plant at Toyama. Intended

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to replace 11 existing smaller units, the new furnace is to manufacture up to 36,000 tons yearly of silicochromium.

Among the minor ferroalloys produced in 1969 were 2,493 tons of ferromolybdenum, 1,154 tons of ferrotungsten, and 2,137 tons of ferrovanadium.

Iron and Steel.—Japan's 1969 crude steel output, while still well below that of the United States and the U.S.S.R., easily exceeded the combined output of the next two producing countries (West Germany and United Kingdom). Per capita production reportedly was 813 kilograms, higher than the United States. About 77 percent of all steel was produced by basic oxygen furnaces (BOF's), 17 percent by electric furnaces, and 6 percent by open-hearth furnaces. Most (97 percent) of the steel manufactured was rolled, with the remainder forged or cast. Total crude steel capacity was estimated at 89.2 million metric tons annually, and pig iron capacity at 57.4 million tons.

Total employment in the steel industry averaged about 340,000 during the year, including about 263,000 production workers and 77,000 administrative, clerical, and technical personnel. The average direct hourly wage (including bonuses) for all steel industry employees in 1969 was $1.29, an increase of 17.2 percent over that of 1968. This compared favorably with national nonagricultural increase of 15.8 percent. Steel industry productivity increased about 21 percent, against an approximate 15 percent rise for all mining and manufacturing. Overall investment in the steel industry in fiscal 1969, as estimated at yearend by industry sources, was $1,812 million.

During the year the steel industry consumed about 93.9 million tons of iron-bearing materials, including a relatively unimportant 3.9 million tons of domestically produced ore, iron sands, and pyrite sinter. Approximately 75 percent of all iron materials were first sintered or pelletized. About 1.1 million tons of principally (70 percent) foreign manganese ore and 32.9 million tons of indigenous limestone were used. Coal consumption was 47.0 million tons, 83 percent of which was imported. Coke use totaled 32.9 million tons, including receipts from gasplants and other nonsteel industry producers. About 31.6 million tons of predominantly (87 percent) domestic scrap was consumed. Petroleum and electric power use totaled 50.6 million barrels and 41.0 billion kilowatt-hours, respectively.

The steel industry contributed favorably again to the national balance of payments, with exports of primary and semimanufactured steel products outweighing imports of raw materials such as iron ore, coking coal, petroleum, scrap, and pig iron. According to Government sources, the resulting surplus in fiscal 1969 (April 1969–March 1970) amounted to $237 million. If exports of manufactured steel products such as machinery were included, an additional estimated $700 million in foreign exchange was provided by the industry.

Consumption and Trade.—Despite another high export level in 1969, the domestic market still consumed approximately 75 percent of steel output or an estimated 61.3 million tons of crude steel equivalent. Construction activity, spurred by Government spending for public works and official support of residential housing construction, accounted for about 50 percent of the national demand. Shipbuilding, the automobile industry, and the manufacture of industrial machinery absorbed slightly less than 10 percent each of domestic consumption. Exports again accounted for slightly more than 25 percent of production in terms of crude steel equivalent.

According to the Japan Iron and Steel Federation, Japanese iron and steel exports rose again in 1969 to a record high of 16.0 million tons, worth $2,297 million. Booming world steel markets were primarily responsible for the increases of 21 percent by quantity and 27 percent by value over the previous year. The largest amount of exports, 6.3 million tons valued at $929 million, again went to North America. Largely because of the voluntary quota on shipments to the United States, however, North American shipments dropped 13 percent by weight, although only 1 percent by value. About 5.4 million tons valued at $751 million was sent to Far Eastern countries, where the largest destination by far was mainland China (1.3 million tons and $173 million). Europe was the recipient of a greatly increased 2.2 million tons valued at $292 million, followed by South America (1.2 million tons and $168 million) Africa (0.5 million tons and $89 million);

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and Oceania (0.4 million tons and $68 million).[2]

Exports to the United States during 1969 reportedly totaled 5,411,000 metric tons, apparently 4 percent in excess of the voluntary Japanese quota of 5,216,000 tons originally agreed upon by parties in both countries. Small nonintegrated Japanese producers not considering themselves bound by the agreement and reluctant to lose the lucrative U.S. market were responsible for 114,000 tons of the overshipments. The remaining 79,000 tons consisted of the first deliveries of 460,000 tons of pipe for the North Slope pipeline in Alaska. Arguing that the pipe contracts had been awarded Japanese firms in the absence of U.S. productive capability and that the pipes should therefore be considered outside of the quota, Japanese negotiators apparently were successful in obtaining agreement that the 1969 pipe shipments were exempted. The quota for 1970 was informally set at 5,370,000 tons, which included a 5-percent increase over the 1969 quota minus the 114,000-ton overshipment by small producers. The status under the quota agreement of the remaining 381,000 tons of pipe destined for Alaska was left undecided.

Structure.—Of the nine integrated steelmakers operating at yearend 1969, six dominated the industry, accounting for approximately 94 percent of pig iron production and 79 percent of crude steel output. These six with their respective shares of national steel production and approximate world rankings among private steel producers, were as follow:

	National steel output share (percent)	World ranking
Yawata Iron and Steel Co., Ltd	19	3
Fuji Iron and Steel Co., Ltd	17	4
Nippon Steel Tube Co., Ltd	14	6
Kawasaki Steel Corp	12	7
Sumitomo Metal Industries, Ltd	12	8
Kobe Steel Works, Ltd	5	25
Other	21	XX
Total	100	XX

XX Not applicable.

At yearend 1969, 19 of the 22 existing or planned integrated plants belonged to the six major companies. These included the two largest operating plants—the 9.0-million-ton-per-year Wakayama plant of Sumitomo Steel and the 8.0 to 8.5-million-ton Fukuyama plant of Nippon Steel Tube. In March, Sumitomo Steel completed the first major production facility—a 1.8-million-ton-per-year hot strip mill—at its new Kashima plant in central Honshu. In addition to Kashima, three of the operating integrated plants (Fukuyama, Kawasaki Steel's Mizushima, and Yawata Steel's Kimitsu) had docking facilities capable of receiving 100,000-deadweight-ton vessels.

All of the major companies were preparing or had underway sizable expansion schemes aimed at meeting a 1975 steel demand estimated at 150 to 160 million tons. Together these projects would lift the crude steel capacity of at least nine of the integrated plants to a minimum of 10 million tons annually. Joint plans for Yawata Steel and Fuji Steel called for raising four plants, one of which (Oita) has yet to begin integrated operations, into the 11- to 12-million-ton range.

The most ambitious and ingenious individual projects, however, were those of Nippon Steel Tube. These involved the expansion of Fukuyama's capacity well beyond the 12-million-ton mark; and the erection of blast furnaces, crude steelmaking facilities, and roughing mills on an artificial island in Tokyo Bay. The island, now primarily a company raw materials unloading and storage area, is to be connected by tunnel with the three still largely independent onshore units of Nippon Steel Tube's Keihin plant. Unfinished steel is to be sent from the island via the tunnel to the three units for rolling. As at present, the Kawasaki unit will continue to roll tubular products, Mizue, hot and cold coils and sheets; and Tsurumi, plates and large diameter pipes. Existing pig iron and crude steelmaking facilities, now operating at each of these units, however, will be phased out.

As part of obtaining consent for a 1970 merger, Yawata Steel and Fuji Steel agreed to carry out various measures intended to strengthen, principally at their own expense, their closest competitors in the production of cast iron, rails, tinplate, and sheet piles. Yawata Steel engaged to sell

[2] U.S. Embassy, Tokyo, Japan. State Department Airgram 459, May 15, 1970, pp. 1–10.

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the cast-iron-producing Higashida No. 6 blast furnace at its Yawata plant to Kobe Steel, and Fuji Steel, the railmaking facilities of its Kamaishi plant to Nippon Steel Tube. Ownership of Yawata Steel's tinplate-manufacturing subsidiary, Toyo Kohan Co., Ltd., was to be effectively transferred to Nippon Steel Tube. Technology for the making of sheet piles was to be made available by Fuji Steel to Kawasaki Steel and by Yawata Steel to Nippon Steel Tube.

New Equipment and Technology.—Eight new blast furnaces were blown in during 1969, bringing the yearend operable total (with retirements) to about 62. Five of the new furnaces had working capacities exceeding 2,600 cubic meters and were capable of producing at least 6,000 tons daily of pig iron. The largest, with 7,000-ton capacities, were the 2,924-cubic-meter No. 3 furnace placed in operation in April at Fuji Steel's Nagoya plant and the 3,016-cubic-meter No. 3 unit which began functioning in July at Fukuyama.

Average pig iron ratio of all furnaces (daily iron output in metric tons per cubic meter) increased from approximately 1:1.72 in 1968 to 1:1.79 in 1969. During November the 2,857-cubic-meter No. 2 furnace at Mizushima produced an average 7,005 tons daily for a ratio of 1:2.45; the iron charge consisted of about 75 percent sinter and pellets and 25 percent sized ore. The charge for all Japanese furnaces was about 62 percent sinter, 13 percent pellets, and 25 percent sized ore. The national ratio of coke consumed to pig iron produced dipped slightly below the 500 kilogram level for the first time.

Full scale testing operations were conducted during midyear at the No. 3 furnace of Fuji Steel's Hirohata plant on a point Fuji Steel-Texaco Development Corp. gas injection process. Residual fuel oil is cracked with oxygen and steam to produce a gas at 1,000° C plus which is then blown into the furnace as a reductant. In addition to lowering coke demand, use of the stock (reducing zone) instead of the hearth (combustion zone) as the entry point for the gas allegedly increases a furnace's thermal efficiency. Results were sufficiently encouraging that further tests were scheduled at a new very high-pressure furnace to be completed at Hirohata in mid–1970.

Approximately nine new BOF's were added during 1969, bringing the total to about 76 with an annual estimated capacity of 73 million metric tons. Five of those newly erected had minimum internal capacities of 350 cubic meters and outputs of at least 220 tons per heat. The average hourly output of all BOF's in 1969 exceeded 190 tons and the average steelmaking time was about 36 minutes. The proportion of killed steel to total BOF production rose to 24 percent. At Fuji Steel's Muroran plant the three 100-ton-plus BOF's of the No. 2 steelmaking ship allegedly set monthly records during November by operating for 2,711 heats at an average heat time of 27 minutes. This surpassed the previous mark of 2,685 heats set by the three 90-ton BOF's of the Keihin plant in October.

Also at Murorna, chromium stainless steel was being produced on a limited but fairly regular basis from a 50-ton BOF at the No. 1 steelmaking shop. Nisshin Steel Works Co., Ltd., a small integrated producer, completed in December, 2 small BOF's at its nonintegrated Shunan stainless steel plant. These were to manufacture stainless steel from pig iron produced in the plant's electric furnaces.

Total national continuous casting capacity was estimated at 4.5 to 5.0 million metric tons annually at yearend in about 26 machines. The largest of the five-odd units reportedly erected in 1969 was a two-strand, vertical, Hitachi-type machine completed near midyear at Fuji Steel's Kamaishi plant to cast up to 25,000 tons monthly of ordinary steel blooms. At Keihin a one-strand, Mannesmann-Bohler, S-curved machine allegedly established another record by having operated for two full years without breakout. At yearend the unit was approaching the mark of 10,000 casts without interruption.

The more conventional roughing mills continued to be built as well. The three principal additions were Fuji Steel's second unit at Nagoya; Kawasaki Steel's second unit at Mizushima; and Nippon Steel Tube's second unit at Fukuyama. Initial annual output capacities of the new units were in the 1.4- to 1.5-million-ton range, but all apparently were to be at least doubled later.

The new hot strip mills were completed, bringing the total to 17 with an annual capacity of about 31 million tons. The total 1969 additions included the pre-

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viously mentioned, fully automated and computerized, 65-inch-wide unit with a top rolling speed of 4,300 feet per minute, installed at Sumitomo Steel's Kashima plant, allegedly the first hot strip mill with 13 (six roughing and seven finishing) stands; and a 90-inch-wide mill with 11 stands which was erected by Yawata Steel at Kimitsu. At Fukuyama, Nippon Steel Tube claimed that an 80-inch-wide hot strip mill produced a monthly record of 407,000 tons during October.

In cold rolling, the most important additions were a five-stand, four-high, 68-inch-wide cold tandem mill constructed by Kawasaki Steel at Mizushima; and two sets of four Sendzimer mills each in tandem, installed at the Shunan plant of Nisshin Steel Co., Ltd., and the Sagamihara plant of Nippon Metal Industry Co., Ltd., respectively.

A subcommittee of the Atomic Energy Committee of the Japan Iron and Steel Institute was established in late 1969 to actively promote the use of atomic energy in the steel industry. No significant new technological advancements were announced during the year in this area, however. Reportedly, interest in the development of low-temperature processes for direct reduction of iron ore to steel was slackening. On the other hand, research allegedly was accelerating on the discovery of methods to eliminate the cooling and reheating stages of slabs between roughing and finishing mills. Use of very high power electric-arc furnaces for the commercial production of steel was initiated in September when Kobe Steel began operating at its Kobe plant a 70-ton-per-charge unit using 42,000-kilovolt-ampere current.

Lead and Zinc.—Production of primary lead and zinc rose strongly again in 1969. The increase in smelter lead moved Japan into the group of third-ranking world producers after the United States and the U.S.S.R. The growth in refined zinc solidified the country's position as the third largest zinc ingot producer. As domestic output of mine lead and zinc increased only marginally, imports of ores and concentrates mounted. Approximately four-fifths of all foreign lead concentrates and about three-quarters of all zinc concentrate imports came from Peru, Australia, and Canada. Exports of unwrought and semi-manufactured zinc almost half of which went to the United States, reached another new high.

Toho Zinc Co., Ltd., the leading zinc ingot producer, had output from its Annaka refinery—the country's largest—in central Honshu restricted near midyear by MITI. Reportedly, this was to alleviate a pollution problem caused by the discharge of cadmium wastes. Expansion plans were then changed by Toho Zinc from enlargement of Annaka to establishment of a new 60,000-ton-per-year refinery at Onahama in northern Honshu. Meanwhile, Japan's second Imperial Smelting Process lead-zinc plant went on stream at Hachinohe in northern Honshu early in 1969. The facility, a joint venture of six Japanese companies in which Mitsui Mining and Smelting Co., Ltd., has the largest (50 percent) interest and management control, was by yearend already producing above its originally announced zinc capacity with additional production capability under construction.

Processing facilities of the lead and zinc industries were approximately as follows at yearend:

Company and facility	Annual capacity (thousand metric tons)	
	Lead	Zinc
Dowa Mining Co., Ltd.:		
Kosaka	2	18
Hachinohe Refining Co., Ltd.:		
Hachinohe	28	64
Mitsubishi Comineo Smelting Co., Ltd.:		
Naoshima	86	---
Mitsubishi Metal Mining Co., Ltd.:		
Akita	---	102
Hosokura	20	22
Mitsui Mining and Smelting Co., Ltd.:		
Hikoshima	---	60
Kamioka	20	56
Miike	---	76
Takehara	10	---
Nippon Mining Co., Ltd.:		
Mikkaichi	---	108
Saganoseki	29	---
Nippon Soda Co., Ltd.:		
Aizu	5	80
Sumiko Imperial Smelting Process Co., Ltd.:		
Harima	80	42
Sumitomo Metal Mining Co., Ltd.		
Kumitomi	20	---
Toho Zinc Co., Ltd.:		
Annaka	---	174
Chigirishima	54	---
Total	254	752

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Nickel.—Sumitomo Metal Mining Co. Ltd.—one of Japan's two nickel ingot producers—overhauled furnaces at its Shisakajima smelter on Shikoku and instituted previously announced plans to expand capacity. Sumitomo Metal additionally arranged for a subsidiary, Dai Nippon Mining Co., Ltd., to change over its small smelter at Hachimori in northern Honshu from the processing of domestic copper ores to the treatment of foreign (Australian) nickel sulfide concentrates. Up to 5,000 tons annually of 70 percent nickel matte is to be shipped from there to Sumitomo Metal's Niihama refinery on Shikoku. Electrolytic capacity of Niihama is being raised to accommodate the greater output from the Hachimori and adjacent Shisakajima smelters. Shimura Chemical Industry Co., Ltd.—the other ingot producer—reportedly also was increasing capacity at its Amagasaki refinery in southern Honshu.

All five ferronickel manufacturers were pursuing expansion plans. Shimura Chemical completed in April one 16,000-kva electric furnace with an annual capacity of 5,400 tons (in terms of nickel content) at a new plant a Muroran (originally planned at Sapporo) on Hokkaido and immediately began construction of a second similar unit. Sumitomo Metal announced plans to expand its Hyuga ferronickel plant on Kyushu from its present 14,000-ton-per-year capacity to about 26,000 tons. Nippon Metallurgical Co., Ltd. leased in October the Toyama plant of Showa Denko Co., Ltd. and began producing 2,400 tons annually of ferronickel from a 9,600-kva furnace; plans have been made to radically increase this output. In October, Nippon Mining Co., Ltd. reportedly completed installation of new equipment at its Saganoseki refinery aimed at raising ferronickel capacity to about 17,000 tons annually.

At yearend, the merger of Pacific Nickel Co., Ltd., with approximately one-quarter share of the ferronickel market, and Nisso Steel Manufacturing Co., Ltd., a small producer of special steels and ferroalloys, into a single ferronickel company with a dominant one-third market position, was imminent. Capacity of the new 6,000-ton-per-year plant completed late in 1969 by Pacific Nickel at Hachinohe in northern Honshu was to be increased to approximately 14,000 tons.

Tin.—As the world's second largest consumer of tin, Japan continued to rely largely on foreign (principally Malaysian) metal to meet demand. In 1969, imports of tin topped 31,000 long tons, roughly 55 percent more than that in 1968. The most important use was in electroplating. At yearend there were some nine tinplate lines in operation. Mitsubishi Metal Mining Co., Ltd., was the largest of the several small indigenous metal producers. Concentrates from the company's Akenobe and Ikuno mines in southern Honshu were smelted in an electric furnace at Ikuno and shipped to its Naoshima facility for refining.

In June, the International Tin Research Council, in collaboration with the Japan Mining Industry Association, opened the Japan Tin Centre in Tokyo.

Titanium.—A third titanium sponge manufacturing company was organized in December when Nippon Soda Co., Ltd., and Teijin Ltd. formed New Metals Industries Co. to produce about 2,200 tons annually of sponge for export to the United States. A new, claimedly cheaper, single-step reduction process using metallic sodium will be employed at a new plant to be completed early in 1971 at Nakago in northwestern Honshu. Both the existing sponge producers, Osaka Titanium Co., Ltd. (annual capacity about 4,800 tons) and Toho Titanium Co., Ltd. (approximately 4,200 tons) use the allegedly more expensive two-step Kroll magnesium reduction process. Together they exported about two-thirds of 1969 sponge production; approximately four-fifths of exports went to the United States.

Uranium.—With the need for uranium oxide to fuel atomic powerplants projected to rise to at least 5,600 metric tons per annum by 1979, and because of severely limited domestic reserves, the Government's Power Reactor and Nuclear Fuel Development Corp. was drawing up a 5-year program to obtain foreign uranium. The plan will begin to operate in April 1970, and apparently will attempt to lessen Japan's present dependency on North American (particularly Canadian) sources of supply. This reliance was heightened late in 1969 when Tokyo Electric Power Co., Inc., agreed to purchase from Cana-

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da's Denison Mines, Ltd., 15,000 metric tons of urnaium oxide over the period 1974–84.

During the plan's first phase intensive investigation is to be undertaken in Canada (British Columbia), the Democratic Republic of the Congo (Kinshasa) and Niger, and basic surveys are to be carried out in Angola, Australia, Nigeria, Senegal, Thailand, and some other provinces of Canada. Joining the nine power and six metal mining companies already engaged in overseas exploration will be at least three coal mining companies seeking to diversify their activities. Included in the plan is the initial establishment in 1970 of a domestic mill which is to eventually produce as much as 130 tons annually of urnaium oxide. Indigenous reserves of minable 0.1 percent uranium oxide, excluding a reported find near midyear Yamaguchi Prefecture in southwestern Honshu, were estimated in 1969 at 2,500 tons.

Other Metals.—Japan was a major world producer or consumer of a great many other metals. Because of its considerable nonferrous base metal smelting and refining capacity, the country ranked second internationally in the production of byproduct bismuth and cadmium, third in selenium, and fourth in tellurium. Its primary metal outputs of gold, magnesium (fifth), mercury (eighth), silver, and titanium (second) also rated among the world's largest.

As a mine producer Japan ranked highly in outputs of gold, mercury, silver, and tungsten. Nevertheless, in most cases indigenous metallic ore outputs were not capable of keeping pace with growing national needs; in many instances production levels stagnated or actually declined. The substantial amounts of foreign metals, usually in the form of concentrates, that had to be imported as a consequence helped make the country the world's greatest importer of metallics.

Antimony concentrate and molybdenite were imported to supplement the small mine outputs of these ores. Large amounts of high-quality manganese and ferruginous manganese ores were imported to supplement the fairly substantial but nevertheless quite inadequate domestic production of ferruginous manganese ore. To compensate for the negligible refractory-grade chromite output, much high-grade chromite had to be imported. Tungsten metal producers relied on concentrate imports for somewhat over half of their raw material, and titanium manufacturers on foreign titanium concentrates (mainly ilmenite but also some rutile) for all of their supply. Mercury imports were almost four times smelter output, while gold imports, initiated in 1967 for the first time since World War II, exceeded by somewhat more than a 2.5:1 ratio refinery output from both domestic and imported concentrates.

NONMETALS

Fertilizers.—The important nitrogenous and phosphatic sectors of Japan's chemical fertilizer industry—third-ranking in world—continued to grow. The first ammonia and urea units under the current "second phase" nitrogenous fertilizer expansion program came on stream at Sakai near Osaka in southern Honshu. Both the butane- and naphtha-fed 1,000-ton-per-day (272,000 tons annually) ammonia unit, and the 1,500-ton-per-day urea facility belonged to Mitsui Toatsu Chemicals, Inc. Completion of the six other ammonia units of roughly similar size under construction at yearend (at least four of which will have any accompanying urea plant) is expected to raise total ammonia capacity in these "second-phase" facilities to 7,600 tons daily or 2.1 million tons annually. Considerable scrapping of older producing units is to proceed concurrently. In April, before scrapping began, existing ammonia facilities consisted of 31 units with individual capacities ranging from 65 to 675 tons daily and a total capability slightly exceeding 9,000 tons. The new urea plants being built under the "second-phase" program will have a total daily capacity of at least 6,100 tons; many older urea plants are also being demolished.

Some progress was reported on the major phosphatic fertilizer complex being built at Niigata in north-central Honshu. Dam Kako Co., Ltd., completed pilot plant testing operations there and began construction of an installation to produce annually 50,000 tons each of potassium sulfate and compound fertilizers using indigenous ammonium sulfate and Israeli potassium chloride as raw materials. At Toyama Nissan Chemical Industries, Ltd., apparently brought on stream a 100,000-ton-per-year nitrophosphate plant intended

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to replace and augment some of its older, smaller facilities elsewhere. Nippon Phosphoric Acid Co., Ltd., evidently started up 68,000-ton-per-year phosphoric acid and 136,000-ton-per-year diammonium phosphate facilities at Goi near Chiba in south-central Honshu. A new 33,000-ton-per-year phosphoric acid plant was to have been put into operations by Toyo Soda Manufacturing Co., Ltd., next to its similar but smaller facility at Tonda in southern Honshu.

Sulfur and Pyrites.—Failure of new petroleum desulfurization facilities to recover as much sulfur as anticipated, coupled with dwindling output from elemental sulfur mines, changed the expected situation of a healthy sulfur surplus in 1969 to one of approaching deficit. Sulfur recovery capacity at refinery desulfurization units rose from 415,000 tons to 526,000 tons annually, but actual sulfur recovered; while roughly double that of 1968, was still only about 142,000 tons. With two of the country's larger elemental sulfur mines (Matsuo and Kusatsu) no longer functioning because of bankruptcy, output of elemental sulfur form mines fell 22 percent to 204,000 tons. As a result, only about 29,000 tons of sulfur was exported by Japan Sulfur Export Co., Ltd., a Government-backed association of 21 sulfur-producing oil firms and seven mining companies formed in July to handle the orderly overseas disposal of substantial surpluses.

Growing demand by the sulfuric acid industry for more sulfur-bearing raw materials placed a heavy strain on its traditional sources—pyrites and flue gases. During the year a number of major new acid units were built, including one by Dowa Mining Co., Ltd., at Okayama in southern Honshu having an annual capacity of 330,000 tons. These raised total sulfuric acid capacity, despite the concomitant closure of numerous older units, to approximately 7.3 million tons annually. Production of sulfide (largely pyritic) ores, in which Japan allegedly leads the world, provided an estimated 1.9 million tons of sulfur for acidmaking. This output, apparently only marginally higher than in 1968, accounted for about 60 percent of the raw materials used. The remaining 40 percent came principally from copper smelter gases. At least one large new sulfuric acid facility scheduled to begin operations in 1970 is planning to use elemental sulfur as raw material.

Other Nonmetals.—Japan produced a considerable variety of nonmetallics, some of them in great abundance. Output of talc-soapstone-pyrophyllite, of which pyrophyllite was by far the most important component, accounted for approximately 37 percent of world supply. Japanese feldspar output, including substitutes, ranked about eighth internationally, constituting approximaely 3 percent of global production.

The nation remained a great world importer of nonmetallic ores, however. There was total dependence on foreign suppliers for magnesite for refractory use, phosphate rock for fertilizer production and mica. To supplement quite inadequate domestic outputs, heavy reliance was placed on imports of asbestos for the construction industry, salt for the chemical industry, high-grade talc for porcelain and toiletries manufacture, graphite (both amorphous and crystalline), and soapstone. Substantial but still deficient production levels were complemented by foreign barite used in the petroleum industry, kaolin consumed by the ceramics industry, high-grade gypsum used in construction and sand consumed in glassmaking.

Nonmetallic exports were mostly of manufactured products. These included principally cement and nitrogenous fertilizers, of which the country has been a leading international exported for some years. The principal exception to the above was in elemental iodine, where Japan was again the world's largest producer and shipper.

MINERAL FUELS

Coal.—The new 5-year, $1.2 billion Government sponsored and subsidized coal industry rehabilitation program went into operation officially in May. Approximately $311 million, or about 85 percent of the industry's total indebtedness, was absorbed outright. Assistance in the form of grants and no interest loans was being extended for the servicing of remaining debt, subsidizing operating costs, improving the overall conditions of miners, facilitating the closing down of inefficient mines, and rehabilitating areas where pit closures affect local economies.

Substantial reorganization of the industry structure proceeded in connection with

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the new program. Of the 16 major companies which accounted for 73 percent of 1969 output, two announced that they would close down completely. Others revealed such diverse plans as splitting up into smaller concerns, concentrating entirely on coal to the exclusion of all other activities, or diversifying into such different fields as overseas uranium or petroleum exploration. Mitsui Mining Co., Ltd., the largest producer, decided to reorganize its offshore Miike colliery on Kyushu to emphasize output of coking coal. The colliery, which produced about 6.4 million tons of bituminous coal in 1969, was to virtually double coking coal output to 3.0 million tons annually while reducing steam coal production some 45 percent to 2.5 million tons. During the year the number of mines operated by the major companies dropped from 40 to about 30. Overall, the number of active mines decreased from 150 to 110.

Total output of coal decreased 5 percent. Bituminous steam coal fell 5 percent to 30,712,000 tons; anthracite 18 percent to 1,225,000 tons; and natural coke 27 percent to 304,000 tons. Bituminous coking coal production increased marginally to 12,449,000 tons. Hokkaido produced 48 percent of all coal; Kyushu 41 percent; and Honshu 11 percent. By far the most important field was Ishikari on Hokkaido, which accounted for about 38 percent of total output, 31 percent of bituminous steam coal and 59 percent of bituminous coking coal. The number of permanent workers declined from about 79,000 to 64,000, while overall productivity rose from 1,788 kilograms per man-shift in 1968 to 2,031 kilograms per man-shift in 1969.

Total coal consumption in 1969 was 86.6 million tons, including 45.3 million tons indigenously produced and 41.3 million tons imported. The steel industry (53 percent) and public utility powerplants (28 percent) accounted for most of use; the former consumed directly 92 percent of foreign coal and the latter 53 percent of domestic coal.

With steel industry demand—estimated at somewhat more than 45 million tons in 1969—forecast to rise sharply, increasing interest was shown in developing overseas supply sources. By yearend an estimated 180 million tons of Canadian coal and 150 million tons of Australian coal had been contracted for over periods ranging up to 17 years. Important Canadian agreements reached during 1969 called for the delivery by Fording Coal Limited of 45 million tons from a British Columbia property over 15 years starting in 1970. In Ausa 24-million-ton supplement to a previous contract signed with a Canadian subsidiary of the Kaiser Steel Corp. of the United States for the shipment of 45 million tons over 15 years starting in 1970. In Australia an agreement was reached with Central Queensland Coal Associates, a subsidiary of Utah Construction and Mining Co. of the United States, for the purchase of 85 million tons during 13 years commencing in 1971.

Late in December, 11 coal mining companies joined with 10 steel companies to form the Japan Overseas Coking Coal Development Co., Ltd. Initial operational plans call for intensive prospecting in western Canada. Also in December, Japanese requirements for the very high-quality coking coal, which still can only be obtained in bulk from the United States, resulted in tentative agreement to loan $25 million to Island Creek Coal Co. to open a new mine in Virginia. This is to produce 30 million tons over a 15-year period for the Japanese market. The project is allegedly unprecedented in Japanese-U.S. minerals trade, representing the first large-scale Japanese loan to a wholly owned U.S. company for mine development.

Petroleum.—*Consumption.*—Demand rose again in 1969, with domestic refined product consumption up approximately 20 percent to 1,051 million barrels. This kept Japan in third place in world consumption. Breakdown of product use was as follows:

Product	Consumption (million barrels)	Increase over 1968 consumption (percent)
Gasoline	114	14
Naphtha	129	37
Kerosine and jet fuel	81	28
Distillate fuel oil	117	14
Residual fuel oil	500	18
Liquefied petroleum gas	78	24
Other	32	14
Total	1,051	20

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Of the 31 marketers the most important were, with their percentage of domestic product market (excluding liquefied petroleum gas): Nippon Oil Co., Ltd. (15.9); Idemitsu Kosan Co., Ltd. (13.4); and the Government-backed Kyodo Oil Co., Ltd. (9.4). Inability of Kyodo Oil to occupy a growing share of the market or show profits led to a major shakeup during the year. This failure was in spite of a continued Government favoritism in extending low-cost loans and granting refinery expansion permits which had allowed Kyodo Oil to acquire 15 percent of the national refining capacity. The most important immediate change involved increasing the offtake prices for products from the 4 refining affiliates of Kyodo Oil. Other anticipated reforms include the infusion of fresh capital, reorganization of the company's marketing system, and greater cooperation among its affiliates.

The Overall Energy Council's Committee on Desulfurization of Fuels recommended in December that the sulfur content of fuel oil consumed in present or future industrial areas be lowered to 1.25 percent by 1973 and 0.80 percent by 1978. If the first target were met, the sulfur content of all petroleum and natural gas consumed in 1973 would therefore be reduced to 1.55 percent. To reach these objectives, the Committee advised the import of low-sulfur crude and fuel oils, particularly of more low-sulfur crude oil for direct burning by powerplants, and of more liquefied natural gas; greater desulfurization of fuel oils and/or fuel gases; and the introduction of central heating and air conditioning plants in urban areas. Government assistance was recommended in the form of subsidies (an estimated $1.3 million was appropriated in fiscal year 1969 for desulfurization research), and support in the orderly marketing of commodities such as sulfur and asphalt which would be produced in large quantities by various desulfurization techniques. At yearend about 243,000 barrels per stream day of fuel oil desulfurization capacity was in operation at 10 refineries and an additional 129,000 barrels under construction for completion in 1970 at four other plants.

Arrangements for imports of liquefied gases multiplied. The most important, involving the delivery of almost 770 million barrels of liquefied natural gas from Brunei over 20 years beginning in 1972, was confirmed in October. Shipments of about 7 million barrels annually of Australian liquefied petroleum gas were to begin in 1970 and were to more than double within 2 years. General agreement was reached for the import of approximately 24 million barrels annually of liquefied natural and petroleum gases from Abu Dhabi, probably starting in 1972. A gas industry survey team was also investigating the possibilities of importing liquefied natural gases from Pakistan and the Australian administered territories of Papua and New Guinea.

Refining.—The overwhelming portion of petroleum needs were met by imports. About 89 percent of crude supply came from the Middle East. Japanese-owned oil companies—specifically, the Arabian Oil Company operating in the Kuwait-Saudi Arabia Neutral Zone and the North Sumatra Oil Development Cooperation Co. functioning in Indonesia—provided almost 11 percent of the imported crude oil. A small (3.5 percent) but increasing amount of foreign crude oil was imported for nonrefining uses, principally for direct burning by powerplants. The average c.i.f. price per barrel of crude was $1.81, compared with $1.91 in 1968.

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Japanese crude refining capacity was estimated at 5,189,000 barrels per stream day at yearend, an increase of almost 16 percent over that at yearend 1968. This apparently moved Japan into third place internationally, behind only the United States and the U.S.S.R. Principal refining increases during the year, including both additions to existing plants and new refineries brought on stream, were as follow:

Company	Refinery	Capacity (thousand barrels daily)	
		Added	Total
ADDITIONS			
Daikyo Oil Co., Ltd.	Umaokoshi	30	105
General Oil Refining Co., Ltd.	Sakai	60	120
Kyushu Oil Co., Ltd.	Oita	60	100
Maruzen Oil Co., Ltd.	Chiba	70	155
Nippon Mining Co., Ltd.	Mizushima	70	165
Showa Oil Co., Ltd.	Kawasaki	40	99
NEW			
Japan Sea Oil Co., Ltd.	Toyama	XX	30
Seibu Oil Co., Ltd.	Yamaguchi	XX	50

XX Not applicable.

The average size of the country's 39 refineries was roughly 82,000 barrels per stream day. Nippon Refining Co., Ltd., whose 220,000-barrel Negishi refinery was still Japan's largest, remained the largest refiner with 342,000 barrels of capacity in four plants.

Government efforts to reduce the costs of imported crude oil and the influence of foreign (mainly United States) concerns over Japanese refining firms achieved partial success in 1969. When, in accordance with the Petroleum Industry Law of 1962, refinery expansion projects were approved in November by MITI for the succeeding 24-month period, foreign suppliers having equity interests in Japanese refining firms were restricted by private agreement to supply a percentage of the crude oil to be processed at the new capacity which would not be in excess to their existing equity share in that firm. They may continue as before, however, to provide the total crude needs of their Japanese affiliates, as long as the price of the remaining crude reflects openly the current competitive market price. An estimated 65 to 70 percent of the foreing crude oil presently imported by Japan is purchased under private agreement between indigenous refiner and associated foreign supplier.

Terminals.—The world's largest crude oil transshipment terminal was completed in October at Kiire in Kyushu. The Nippon Oil Staging Terminal Co., Ltd., has a 7.6-million-barrel storage capacity and a berth capable of handling the largest tanker now afloat. By yearend some 11 vessels of 200,000 to 300,000 deadweight tons were to have been received from abroad. Crude oil was being transshipped from a separate berth in "coastal" tankers of 30,000 to 150,000 tons to six refineries in Honshu.

Exploration.—By yearend mining rights had been filed for approximately 82,000 square miles of Japan's estimated 108,000-square-mile Continental Shelf. All but one of the six Japanese applicants were in some sort of association with U.S. petroleum companies. Idemetsu Kosan Co., Ltd., and the Government's Japan Petroleum Development Corporation (KODAN) completed with the assistance of Standard Oil (Indiana) a seismic survey off Akita and Yamagata Prefectures in northwestern Honshu. A similar investigation was carried out off Tottori and Shimane Prefectures in southwestern Honshu by the West Japan Petroleum Development Co., Ltd., a joint undertaking of the Mitsubishi combine and Royal Dutch/Shell affiliates. Nippon Oil Exploration Co., Ltd., reached general agreement with subsidiaries of California Texas Oil Corp. to develop petroleum in Nippon's acreage off southwestern Kyushu, while Mitsui Mining Co., Ltd., attained tentative accord with Continental Oil Company on exploiting Mitsui's concession off northern Hokkaido. In addition, Teikoku Oil Co., Ltd., was apparently still considering at yearend a rather more comprehensive relationship with Gulf Oil Corp.

At least $47 million was to have been expended in fiscal 1969 in overseas oil exploration and development by the 12 private Japanese petroleum firms engaged in some 15 foreign projects. Two of the projects were in the production stage and at least nine others involved exploratory drilling. Loans to and investments in these concerns by KODAN were to amount to about $32 million.

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The Mineral Industry of Kenya, Tanzania, and Uganda

By Eugene R. Slatick [1]

In 1969, Kenya, Tanzania, and Uganda together produced minerals valued at $83.5 million,[2] up from $70.6 million in 1968. The rise was due to increases in the value of production in Tanzania and Uganda; value dropped in Kenya. These countries comprise the East African Common Market (EACM). The value of total exports and imports within EACM by country in 1968 is summarized as follows, in million dollars:

EACM exporting country	Total EACM exports	Total EACM mineral exports	Destinations of mineral exports		
			Kenya	Tanzania	Uganda
Kenya	73.7	15.3	---	6.6	8.7
Tanzania	12.7	1.2	0.9	---	0.8
Uganda	29.9	1.8	1.0	0.8	---

The mineral industries of the EACM continued to be served by East African Railways and Harbors, a part of the East African Common Services Authority.[3] In 1968 the railroads hauled about 4.7 million tons of materials, including about 1.2 million tons of mineral commodities. During 1968 East African ports handled import and export tonnages totaling 8.1 million deadweight tons (d.w.t.), including 3.7 million d.w.t. of bulk oil. Oil bunkering was as follows: Mombasa, Kenya, 534,959 d.w.t.; and Dar es Salaam, Tanzania, 3,298 d.w.t.

KENYA

Kenya's mineral industry continued to hold a small place in the country's economy in 1969. Mineral production was valued at $18.8 million, compared with about $20 million in 1968. As in past years, the major mineral commodities were cement ($13.1 million) and soda ash ($2.7 million).

Statistics for the mining industry in 1967, the most recent year available, are summarized as follow:[4] Labor force, 1,153; expenditures, $3,787,507 (prospecting, $2,806,731; mine development, $118,107; mining and milling, $862,669); and Government revenue from the industry for fiscal year July 1966 to June 1967, $35,143, mainly from mining fees and royalties. At the beginning of 1968 there were 594 mining claims, of which 339 were for nonprecious minerals. A total of 435 of these claims were located in the Rift Valley Province.

In June the Government proclaimed that Kenya's territorial waters extend 12 miles off the coast. The territorial waters of Pemba Channel is delimited by a median line between Kenya and Tanzania. Formosa Bay, in the north, is considered as part of the country's internal waters.

The details of Kenya's 20-year national power development plant for 1966–86 were

[1] Foreign mineral specialist (petroleum), Bureau of Mines, Washington, D.C.

[2] Where necessary, values have been converted at the following rates: Kenya shilling 1, Tanzania shilling 1, and Uganda shilling 1 = US$0.14.

[3] East African Railways and Harbors. Annual Report, 1968, 1969, pp. 64–66.

[4] Republic of Kenya, Mines and Geological Department. Annual Report, 1967. 1969, pp. 12–14.

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released during 1969. Geothermal steam in the Rift Valley was not included in the plan because engineering studies to date have been inconclusive. There is a possibility, however, that Kenya's geothermal steam can be utilized to generate electricity. The most promising supply of steam is in the Lake Hannington area, about 40 miles north of Nakuru.

PRODUCTION AND TRADE

The available data for mineral production and trade are given in the following tables:

Table 1.—Kenya: Production of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Beryllium, beryl concentrate, gross weight	17	7	3
Copper, mine output, gross weight	11	37	77
Gold, mine output, metal content, troy ounces	33,866	31,974	17,903
Silver, mine output, metal content, do	3,038	2,769	1,668
NONMETALS			
Abrasives, natural, n.e.s.: Corundum	25	43	119
Asbestos	51	----	----
Barite	212	356	435
Carbon dioxide, natural	817	819	762
Cement, hydraulic, thousand tons	479	545	653
Clays, kaolin	1,456	1,332	1,472
Diatomite	1,886	2,055	2,303
Feldspar	402	535	1,560
Gemstones, precious and semiprecious, except diamond: [1]			
Garnet [2], kilograms	158	210	115
Sapphire, carats	8,308	28,055	14,195
Gypsum and anhydrite, crude	40,446	41,089	61,848
Magnesite, crude	422	68	503
Meerschaum, kilograms	143	82	1,853
Pumice	122	----	----
Salt:			
Rock, thousand tons	25	33	5
Marine, do	24	28	37
Soda, raw crushed (trona)	3,224	2,283	2,568
Soda, ash	104,755	117,250	105,913
Stone, sand and gravel n.e.s.: Limestone, crushed and broken, other than for cement	19,041	r 18,568	NA
Vermiculite	251	279	776
Wollastonite	12	1,382	691
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline, motor, thousand 42-gallon barrels	2,261	2,201	2,507
Kerosine, do	1,646	1,591	2,100
Distillate fuel oil, do	2,783	2,954	3,230
Residual fuel oil, do	6,580	6,387	6,760
Liquefied petroleum gas, do	71	94	106
Asphalt and bitumen, do	306	252	315
Total, do	13,647	13,479	15,018

r Revised. NA Not available.

[1] Small amounts of the following gem materials were also reported in 1969: Aquamarine, amethyst, apatite, fluorite, ruby, and tourmaline.

[2] Quality (gem or industrial) not specified.

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Table 2.—Kenya: Exports of major mineral commodities to countries outside the East African Economic Community [1]

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Beryllium, beryl ore and concentrate		16	7
Gold, metal, unworked or partly worked	troy ounces	26,942	24,772
Iron and steel: Metal:			
Scrap		5,578	2,406
Semimanufactures		198	NA
Other, nonferrous metals, scrap		2,247	1,882
NONMETALS			
Abrasives		-------	569
Cement		221,189	239,039
Diatomite and other infusorial earths		734	NA
Fertilizer materials, manufactured		-------	1,352
Salt and brines		774	1,580
Sodium compounds, soda ash, sodium carbonate		98,330	112,495
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	249	191
Kerosine	do.	729	559
Distillate fuel oil	do.	865	802
Residual fuel oil	do.	4,615	4,152
Liquefied petroleum gas	do.	1	25
Asphalt	do.	11	104

NA Not available.
[1] Excludes reexports.

Table 3.—Kenya: Imports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Copper, metal, including alloys, all forms		264	588
Gold bullion	troy ounces	6,748	7,318
Iron and steel:			
Ore and concentrate		5,588	-----
Metal:			
Scrap		16	1
Pig iron, ferroalloys, and similar materials		1,362	961
Steel, primary forms, ingots and other		151	270
Semimanufactures		644,117	669,411
Lead, all forms		312	279
Tin, all forms	long tons	28	1,024
Zinc, all forms		1,046	1,181
Other, nonferrous metal scrap		67	121
NONMETALS			
Asbestos		55	-----
Cement		834	2,945
Clays and clay products, refractory products (including nonclay bricks)		1,146	804
Feldspar, fluorspar, cryolite, and chiolite		4,396	962
Fertilizer materials: Manufactured:			
Nitrogenous		29,266	23,303
Phosphatic		15,646	19,422
Potassic		771	2,316
Other, including mixed		19,073	12,071
Graphite, natural		18	10
Lime		46	108
Mica, crude, including splittings and waste		22	32
Salt and brines		5,046	7,692
Stone, sand and gravel		613	11,809
Sulfur, elemental, all forms		253	519
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades, including briquets		48,898	40,302
Coke and semicoke		1,242	1,373
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	14,228	14,212
Refinery products:			
Gasoline	do.	129	422
Kerosine	do.	252	195
Distillate fuel oil	do.	422	678
Residual fuel oil	do.	243	71
Lubricants	do.	154	239
Other	do.	32	28

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COMMODITY REVIEW

Metals.—*Iron and Steel.*—In June East African Wire Industries, Ltd., and the Development Finance Company of Kenya signed an agreement to build Kenya's first rolling mill at Miritini, near Mombasa. It will be operated by the newly formed Kenya United Steel Co. Operations are scheduled for early 1970 at the rate of about 20,000 tons of rods and bars per year. The mill's capacity, however, will be about 36,000 tons. Because the domestic supply of scrap is too limited to justify a foundry operation, the mill will process imported material. The output from the $2.1 million mill is planned to supply the domestic and export markets.

Uranium.—During the year, Tokyo Electric Power Co., Inc., and eight other Japanese electric power companies announced plans to send a survey team to Kenya to study the possibility of developing the country's uranium resources.

Mineral Fuels.—*Petroleum.*—The daily crude-oil distillation capacity of the refinery at Mombasa is to be expanded in 1970 from about 44,000 barrels to about 50,500 barrels. In 1969 a 420,000-barrel-per-year lubricating-oil plant was under construction. It will cost about $10 million and is expected to be operating by 1972. The Governments of Kenya and Uganda considered the possibility of jointly constructing a petroleum pipeline from the coast to Kampala, Uganda.

TANZANIA

In 1969 diamond continued to dominate Tanzania's mineral industry. Diamond production during the year was valued at about $25 million, up from about $19 million in 1968. The value of total mineral production in 1969 was about $31.1 million. Out of a total mineral trade valued at $22 million in 1968, diamond accounted for about $19 million, or about 86 percent. All diamond exports were to the United Kingdom.

Tanzania's second 5-year plan (1969–74) calls for an aggressive policy of geological surveying and mineral exploration, followed by rapid development.[5] Included among the investigations in 1969 were a copper-nickel anomaly near the Piti River; a copper prospect south of Chunya (two holes were drilled to over 400 feet); a suspected gold occurrence along the Kikama River; the reexamination of a magnesite property in the area near the Pare Mountains; a detailed study of tanzanite (gem zoisite) deposits; and country-wide studies of phosphate and kaolin deposits.[6]

In 1970 a team of about 80 geologists from the U.S.S.R. is expected to begin geologic mapping over a 170,000-square-mile area in western Tanzania, from Mpanda to Lake Rukwa. Detailed prospecting for minerals will be done over about half of the area and the Lupa goldfield. The team will stay for 4 years under a technical credit and trade agreement signed in 1966. Other countries assisting or planning to assist Tanzania in exploration are Canada, Italy, mainland China, Rumania, and West Germany.[7]

In November, the Governments of Tanzania, Zambia, and mainland China signed an agreement for the construction of a 1,100-mile railroad from Dar es Salaam to Zambia's copper belt. The railroad, which will cost an estimated $300 million, is scheduled to be completed in 1974. In addition to providing an outlet for Zambia's copper exports, the railroad is expected to provide an incentive for mineral development in southwest Tanzania, particularly the area's iron and coal reserves.

Early in the year the World Bank and the International Development Association gave Tanzania a $30 million loan to rebuild 310 miles of the Tanzam Highway, which extends for nearly 1,000 miles from Zambia's copper belt to Dar es Salaam. The highway has been Zambia's main route for traffic diverted from Rhodesia since Rhodesia's unilateral declaration of independence in 1965.

PRODUCTION AND TRADE

The available data for mineral production and trade are shown in the following tables:

[5] Ministry of Commerce and Industries. Second Five Year Plan Pamphlet, 1969–1974. Dar es Salaam, 1969, pp. 8–12.

[6] Mineral Resources Division, Ministry of Commerce and Industries. Review of the Mineral Industry of Tanzania for the Year 1969. Dodoma, 1970, 8 pp. This report provided a large amount of information for other parts of this subchapter.

[7] Mining Journal (London). V. 274, No. 7011, Jan. 2, 1970, p. 5.

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Table 4.—Tanzania: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1967	1968	1969
METALS				
Gold, mine output, metal content	troy ounces	18,523	17,473	16,016
Silver, mine output, metal content	do.	2,294	2,387	2,028
Tin, concentrate	long tons	r 460	r 322	178
Tungsten, concentrate		48	31	18
NONMETALS				
Clays:				
Bentonite		208	---	---
Kaolin (including china clay)		312	606	744
Cement, hydraulic		146,918	156,331	169,404
Diamond: Gem and industrial	carats	926,757	702,395	777,290
Gem stones: [2] Precious and semiprecious, except diamonds	kilograms	7,679	15,621	2,107
Gypsum and anhydrite, crude		15,479	4,461	11,032
Lime (quicklime and hydrated lime)		5,164	6,950	10,914
Magnesite, crude		2,038	1,447	1,546
Meerschaum		56	1	11
Mica:				
Sheet		77	72	97
Scrap		126	239	115
Quartz, glass sand		1,417	2,089	2,711
Salt, all types	thousand tons	36	30	34
Stone, ornamental:				
Artstone [3]		8	8	11
Amethystine quartz		5	3	7
Travertine		22	---	---
Vermiculite		91	80	127
MINERAL FUELS AND RELATED MATERIALS				
Coal, bituminous	thousand tons	2	8	8
Petroleum refinery products:				
Gasoline, motor	thousand 42-gallon barrels	911	927	926
Kerosine	do.	234	251	256
Jet fuel	do.	322	300	291
Distillate fuel oils:				
Gas oil	do.	1,424	600	704
Diesel oil	do.		801	268
Residual fuel oil	do.	1,986	2,212	2,076
Liquefied petroleum gas	do.	39	37	37
Total	do.	4,916	4,628	4,558

r Revised.

[1] In addition to commodities listed, construction materials such as clay, sand, gravel, and stone are produced, but quantitative data are not available.

[2] Includes amethyst, aquamarine, chrysoprase, corundum, garnet, ruby, sapphire, tourmaline, zircon, and zoisite.

[3] Corundum-zoisite.

Table 5.—Tanzania: Exports of major mineral commodities to countries outside the East African Economic Community [1]

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum, metal, including alloys: Semimanufactures		148	81
Gold, metal, unworked or partly worked	troy ounces	18,486	17,474
Iron and steel: Metal:			
Scrap		3,691	1,293
Semimanufactures		337	NA
Silver, metal, including alloys	troy ounces	2,293	2,386
Tin, ore and concentrate	long tons	535	385
Tungsten, ore and concentrate		47	31
Other, nonferrous metals, scrap		541	1,028
NONMETALS			
Artstone [2]		3	3
Cement		17,682	29,076
Diamond, all grades	carats	987,605	682,651
Gypsum and plasters		---	31
Magnesite		---	1,080
Mica, all forms		266	260
Precious and semiprecious stone, except diamond	kilograms	r 940	820
Salt and brines		11,089	10,779
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	795	1,034
Kerosine	do.	252	368
Distillate fuel oil	do.	728	1,455
Residual fuel oil	do.	813	1,233
Liquefied petroleum gas	do.	---	5
Other, asphalt and bitumen	do.	---	1

r Revised. NA Not available.

[1] Excludes reexports.

[2] Corundum-zoisite rock; includes rough amethystine quartz.

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Table 6.—Tanzania: Imports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys:		
Unwrought	683	2,056
Semimanufactures	201	164
Copper, metal, including alloys, all forms	54	149
Gold bullion, troy ounces	556	62
Iron and steel:		
Ore and concentrate	1,908	2,258
Metal:		
Pig iron, ferroalloys, and similar materials	1,632	1,014
Steel, primary forms:		
Ingots and other	205	1
Semimanufactures	92,697	275,134
Lead, all forms	29	65
Tin, all forms, long tons	21	114
Zinc, all forms	1,124	1,851
Other, nonferrous metal scrap	130	154
NONMETALS		
Abrasives, natural, n.e.s., grinding and polishing wheels and stones	42	99
Cement	3,487	6,255
Clays and clay products, refractory products (including nonclay bricks)	1,030	405
Feldspar, fluorspar, cryolite, and chiolite	---	30
Fertilizer materials: Manufactured:		
Nitrogenous	11,245	2,354
Phosphatic	1,188	2,676
Potassic	1,464	1,449
Other, including mixed	8,431	12,963
Graphite, natural	11	31
Lime	840	639
Mica, crude, including splittings and waste	10	24
Salt and brines	3,190	5,792
Stone, sand and gravel	535	6,345
Sulfur, elemental, all forms	273	414
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets	111	48
Coke and semicoke	199	920
Petroleum:		
Crude and partly refined, thousand 42-gallon barrels	4,948	5,427
Refinery products:		
Gasoline, do.	267	472
Kerosine, do.	69	13
Distillate fuel oil, do.	446	1,027
Residual fuel oil, do.	---	4
Lubricants, do.	78	92
Other, do.	15	10

COMMODITY REVIEW

Metals.—*Gold and Silver.*—Production of gold and byproduct silver continued to decline. Buhemba Mines Ltd., a subsidiary of Williamson Diamonds, Ltd., remained the chief producer. It milled about 54,000 tons of ore and recovered 15,084 troy ounces of gold and about 1,700 troy ounces of silver. The mine operated at a loss during the year. Operations are expected to stop during the first half of 1970 because no new ore reserves have been found. Reserves at yearend were reported as being sufficient for only 3 months of operation.

Mining continued on a small scale in the Geita, North Mara, Lupa, and Mpanda areas. Late in the year the Government requested Williamson Diamonds, Ltd., to undertake development of the Buck Reef gold prospect in the Geita District. The prospect was discovered in 1968 by an exploration program carried out by the United Nations Special Fund and the Mineral Resources Division of Tanzania.

Iron and Steel.—Under the second 5-year plan studies will continue on the possibility of exploiting the titaniferous magnetite deposits at Liganga. A determining factor is whether laboratory techniques for producing iron from the ore can be enlarged to an industrial scale. The deposits, which total about 78 million tons, contain 49 percent iron and 13 percent titanium dioxide.

Late in the year the National Development Corporation announced that Fried. Krupp Huttenwerke will send a survey team to Tanzania to evaluate the country's iron ore deposits, which are estimated to total 250 million tons. The 10,000-ton-per-year steel-rolling mill of National Steel Rolling Mill, Ltd., was under construction at Tanga. It is expected to be operating in early 1970.

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Tin.—Production of tin concentrate declined sharply due to decreased output from both the Kaborishoke mine of Kyerwa Syndicate Ltd. and small-scale operators. The Kaborishoke mine, which had been operating under new management since March 1968, changed ownership again in November 1969. The mine accounts for one-third to one-half of total production.

Nonmetals.—*Cement.*—The annual capacity of the Wazo Hill cement plant of the Tanzania Portland Cement Co. Ltd. is to be increased from about 160,000 tons to 400,000 tons by late 1971. The increase is in response to heavy demand for cement from the domestic building industry. There is also a possibility of increasing exports. Reserves of coral limestone are reported to be sufficient for at least 80 years.[8] Gypsum is obtained from the company's mining property and from local producers. The company has a labor force of 285.

Clay and Quartz (glass sand).—Tanzania Refractories and Bricks Ltd. built a modern, 25-ton-per-day, kaolin beneficiation plant in the Pugu Hills. All the production of glass sand reported during the year was obtained as a byproduct of processing the kaolinitic sandstones in the Pugu Hills.

Diamond.—As in past years, essentially all diamond production was by Williamson Diamonds, Ltd., and its subsidiaries, New Alamasi Ltd. and Kahama Mines Ltd. Williamson Diamonds Ltd., at Mwadui, mined a record tonnage of about 3.4 million metric tons of ore, from which 731,294 carats was obtained. This was 27 percent more than expected and represents a grade of 21.5 carats per hundred tons as compared with 20.1 carats in 1968. Because of the larger tonnages treated, the cost per ton mined and treated was about 6 percent less than in 1968. New ore reserves were found in marginal ground away from the kimberlite pipe.

The company continued prospecting near Mwadui and elsewhere. Two kimberlite pipes were found south of Mwadui, but they were uneconomic. Two special prospecting licenses were taken out for areas between Mwadui and Shinyanga and west of Nzega. The search for diamond continued in the Mapiringa area and at the Ngualla carbonatite.

During the year the mine of New Alamasi, Ltd. treated 557,225 tons of ore and obtained 32,695 carats of diamond (5.9 carats per hundred tons, compared with 5.5 carats in 1968). The working costs increased substantially because of the higher costs of power and water.

Kahama Mines, Ltd., continued to operate at a loss. Operations were stopped several times during the year because of breakdowns in the powerplant. The company treated 244,296 tons of ore and recovered 13,277 carats (5.4 carats per hundred ton, compared with 5.2 in 1968).

Fertilizer Materials.—The site of the fertilizer plant of Tanzania Fertilizer Corporation, Ltd., was changed from Dar es Salaam, near the petroleum refinery, to Tanga. It is scheduled to be operating in 1971 with a capacity of 105,000 tons per year.

Other Gem Stones.—The Gemstone Industry (Development and Protection) Act was passed during the year. Its purpose is to promote the industry and curb illegal sales of gem stones. The gemstone Industry Advisory Board was established, but the official gem valuation and marketing organization was not yet set up.

Tanganyika Gemstone Industries, Ltd., was registered, and a site for its proposed cutting and polishing plant was selected at Moshi. The tentative ownership of the company consists of Tanzania's National Development Corporation (55 percent) and Continental Ore Corp., a U.S. firm (45 percent).

Prospecting continued largely in the northern half of the "Mozambique Belt" of rocks, although there were reports of discoveries in the more southern parts. The area around Nachingwea, farther south, is a potentially favorable area, but has not yet attracted many prospectors.

Salt.—Production of salt from the Uvinza brine springs by Nyanza Salt Mines, Ltd., reached 24,830 tons. The demand for salt exceeded production, however, and the company had to import salt from India to meet market demands. An early plan to increase production by installing a modern vacuum plant has not been carried out. The company was awaiting a report on the feasibility of reverting to solar pan production.

[8] Tanzania Trade and Industry. £ 1.5m Extensions at Cement Factory in Tanzania. No. 26, July 1969, pp. 12–13.

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Almost 9,000 tons of salt, all for local consumption, was produced from coastal salt works. During the first half of the year no salt was produced by Messrs. H. J. Stanley and Sons Ltd., the largest coastal salt producer, because of heavy rains. During the rest of the year the company produced 2,959 tons. If the company can hire enough workers, production is expected to increase by 50 percent because an additional 7 acres of crystallizing pans were built at Utondwe.

Mineral Fuels.—*Coal.*—According to a study made by a team of Chinese Communists in 1966 and released in 1969, Tanzania's inferred coal reserves total about 1,500 million tons. The second 5-year plan calls for further evaluation of the coal deposits, particularly with regard to their being utilized in association with the possible exploitation of the iron ore deposits at Liganga. The coal-bearing areas are about 35 miles south and about 90 miles northwest of Liganga.

Petroleum.—During the year the Government established the Tanzania Petroleum Development Corporation, with Agip S.p.A. as contractor, to explore the entire coastal onshore and offshore region, an area totaling about 12 million acres. Agip, a subsidiary of Italy's Ente Nazionale Idrocarburi (ENI), has a contract for 30 years with an option for a 15-year extension. Agip is to bear all costs until oil is found in commercial amounts, after which the prospecting expenses will be treated as a loan to be repaid from the production. Further profits will be divided between the Government and Agip in a ratio depending on the rate of production. Oil has been sought in the coastal area in the past, but without success. Previous concession rights, which lapsed in 1964, were held for about 13 years by British Petroleum-Shell Petroleum Development Company.

UGANDA

In 1969 copper mining and smelting continued to be Uganda's principal mineral industry. The value of blister copper production rose to about $25.3 million, compared with $19.4 million in 1968. Total mineral production in 1969 was valued at $33.6 million.

An aerial geophysical survey covering about 12,000 square miles located areas with promising mineral prospects and stimulated interest in mineral development. The report of the survey, which was financed by the United Nations Development Program and the Uganda Government, recommends further investigation of sulfide occurrences in the Karamoja District and drilling to determine the extent of sulfide mineralization in the Rom and Bobong areas. Encouraging indications of manganese and lead have been found, and exploration was under way to find extensions of the Kilembe copper deposits. To encourage mineral development, a state mining corporation was established to help finance the exploitation of certain minerals, particularly those requiring a relatively small capital investment.

Two exploration projects began in the southern part of the country during the year. Under an agreement between the Government and West Germany, the area will be explored for 2 to 4 years, apparently only for base metals. Another agreement gave Gryberg and Associates, a United States firm, a license to explore for radioactive minerals in a 30,000-square-mile area in the same general region. Little geological exploration has been done in that region because mineral rights belonged to private landowners until 1967, when the rights were transferred to the Government under the new constitution.

During the year an 11-man geological survey group from the U.S.S.R. arrived to study the western and eastern parts of Uganda.[9]

In late October the Government approved a charter aimed at nationalizing privately controlled businesses in the country. In January 1970 the State-owned Uganda Development Corp. Ltd. sought to increase its interest in Kilembe Mines Ltd. from 10 percent to 55 percent by buying half of the 70-percent interest of Kilembe Copper Cobalt Ltd. and half of the 20-percent interest of Commonwealth Development Corp. Kilembe Copper Cobalt, Ltd., is a Canadian company, and Common-

[9] Barclays Overseas Review (London). July 1969, p. 40.

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wealth Development Corp. is British. The total assets of Kilembe Mines Ltd. were valued at $20.7 million at yearend 1969. Several U.S. petroleum companies have marketing subsidiaries in Uganda.

PRODUCTION AND TRADE

The available data for mineral production and trade are listed in the following tables:

Table 7.—Uganda: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Beryllium, beryl concentrate, gross weight	314	361	287
Bismuth, mine output, metal content—kilograms	481	r 713	p 2,400
Columbium and tantalum, ores and concentrates, gross weight—kilograms	27,108	• 27,000	p 1,900
Copper, metal, blister, primary	14,426	15,597	16,572
Gold, mine output, metal content—troy ounces	14	35	p 13
Iron and steel, steel semimanufactures—thousand tons	24	26	25
Tin, mine output, metal content—long tons	111	228	p 146
Tungsten, mine output, metal content	80	98	p 111
NONMETALS			
Cement, hydraulic—thousand tons	139	156	170
Fertilizer materials: Crude (natural): Phosphates: Apatite	146,719	• 142,240	NA
Lime (quicklime and hydrated lime)—thousand tons	185	20	NA
Lithium minerals, amblygonite	44	44	p 6
Salt, evaporated—thousand tons	NA	---	p 5

• Estimate. p Preliminary. r Revised. NA Not available.

Table 8.—Uganda: Exports of major mineral commodities to countries outside the East African Economic Community [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Beryllium, beryl ore and concentrate	315	483
Copper, metal, blister and other unrefined, unalloyed	14,975	15,632
Iron and steel, metal: Semimanufactures	591	NA
Tin, ore and concentrate—long tons	189	291
Tungsten, ore and concentrate	148	102
Other, nonferrous metals, scrap	988	739
NONMETALS		
Cement	5,522	5,189
Fertilizer materials	---	172
Salt and brines	1,641	1,970

NA Not available.
[1] Excludes reexports.

Table 9.—Uganda: Imports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys: Semimanufactures	376	745
Copper, metal, including alloys, all forms	92	177
Gold bullion—troy ounces	2,745	1,173
Iron and steel:		
Metal, pig iron, ferroalloys, and similar materials	576	552
Steel, primary forms, ingots and other	500	1,606
Semimanufactures	42,092	512,172
Lead, all forms	122	42
Tin, all forms—long tons	22	121
Zinc, all forms	1,254	911
NONMETALS		
Asbestos	776	1,296
Cement	674	1,585
Clays and clay products, refractory products (including nonclay bricks)	1,886	2,216
Feldspar, fluorspar, cryolite and chiolite	1,520	1,544
Fertilizer materials: Manufactured:		
Nitrogenous	7,866	2,252
Phosphatic	973	945
Potassic	1,499	3,805
Other, including mixed	6,718	8,588
Salt and brines	26,337	40,083
Stone, sand and gravel	774	1,024
Sulfur, elemental, all forms	2,790	1,614
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets	67	86
Coke and semicoke	364	354
Petroleum refinery products—thousand 42-gallon barrels	156	79

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COMMODITY REVIEW

Metals.—*Beryl.*—A group representing the Japan Society of Newer Metals held discussions in Uganda regarding the possibility of buying beryl in quantity.[10] If this leads to a long-term contract and an assurance of prices, Uganda's beryl reserves could be exploited more efficiently. Beryl is mined presently by inefficient selective methods that are estimated to result in a recovery of less than half the ore present. Production could rise sharply if more efficient methods were used. Deposits of beryl in Ankile and Kigezi districts are estimated to total 80,000 tons, but only 28,000 tons of this is considered economical to mine under present mining methods.

Copper and Cobalt.—Kilembe Mines Ltd. continued to be the country's only copper producer and major mining company. Despite a labor strike of about a week, the company's output rose in 1969. It mined 1,009,000 tons of ore, shipped 998,379 tons from the mine, and milled 979,762 tons averaging 1.93 percent copper.[11] Beginning in 1968 all the copper has been exported to Japan under a 5-year agreement signed early that year.

Exploratory drilling in 1969 rose to 96,550 feet (92,985 feet in 1968). Development work continued to decline, and totaled 39,448 feet (50,711 feet in 1968). A new ore deposit was located in the Namhuga area about 4,000 feet southeast of the main mine. The reserves and tenor of ore at yearend 1969 were as follows: Proved, 4.1 million tons at 1.89 percent copper; probable, 1.3 million tons at 2.07 percent; possible, 2.3 million tons at 1.79 percent.

In late October, Kilembe Mines Ltd. announced plans to build a smelter at Kilembe to produce cobalt from stocks of cobaltiferous pyrite, a byproduct of copper mining. The move was prompted by the rise in the price for cobalt, previous prices were too low to permit the exploitation to be done profitably. Construction of the $4.2 million smelter is to begin in mid-1970. Production of cobalt matte is scheduled to begin in 1971 at a rate of 500 tons per year. The matte will be shipped for further treatment to Kristiansand, Norway, where Kilembe's parent company, Falconbridge Nickel Mines Ltd. of Canada, has an electrolytic refinery. The stocks of cobaltiferous pyrites average 1.3 percent cobalt and total about 700,000 tons.

Iron and Steel.—According to a study begun in 1966 by a Japanese team, Uganda has the potential of having an iron and steel complex in the future.[12] Ore deposits are considered to be large enough to support such an industry. The major source of ore would be the magnetite deposits at Sukulu, which have been estimated at over 30 million tons.

Tungsten.—Uganda's Geological Survey and Mines Department confirmed the presence of wolframite about 45 miles northeast of Mbarara. The discovery is the first indication of economic mineralization in that area. The deposits of wolframite being mined are to the southwest, near Kabale. The new deposits were being evaluated, and further exploration is to be extended to the surrounding country.

Nonmetals.—*Cement.*—A cement plant began operations at Hoima in September or October.[13] The initial output is estimated to total about 100 tons per day.

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[10] The Financial Times. London. Oct. 6, 1969, p. 17.
[11] Kilembe Copper Cobalt Ltd. Annual Report. 1969. 12 pp.
[12] Page 17 of source cited in footnote 10.
[13] Mining Journal (London). V. 273, No. 6991, Aug. 15, 1969, p. 135.

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The Mineral Industry of North Korea

By R. A. Pense [1]

North Korea depends heavily on mining and metallurgical processing to support its moderately industrialized economy, which already possesses well-established heavy machinery and machine-tool industries. While no major mineral industry developments were reported in 1969, the country continued to be a mineral and metal producer of second-rank importance in the Far East, well ahead of South Korea, although not comparable to mainland China or Japan. In particular, output of tungsten, graphite, and magnesite was again prominent by world standards. Lead, zinc, barite, and talc-soapstone-pyrophyllite were also of some global importance. Domestically, iron ore and anthracite were significant from the viewpoint of supporting North Korea's medium-scale iron and steel industry.

In the 1969 draft budget of about 5,995 million won, total expediture on capital construction was to increase 37 percent over that of the previous year. The following mineral-related industries were to receive capital allocation increases over 1968 levels, as follow, in percent: Metallurgy, 130; building materials, including cement, 180; and chemicals, 220. Although investment amounts apparently were not given for the mining and electric power industries, upon which the entire economy was stated to be dependent, these were again declared priority sectors. Mine development, particularly that of strip mines and of small- and medium-size underground mines, was to be accelerated, rock tunneling and face preparation efforts stepped up, work better planned, and new machinery introduced. Electric power facilities were to be operated to the fullest extent, and the output used more economically.

In the metallurgical industry, and particularly in the steel sector, emphasis again seemed to be on improving the operational efficiency of existing plants and equipment. There were injunctions to lower the coke to pig iron ratio, decrease the average heat time of furnaces, employ oxygen blowing to a greater extent, and use better grade refractories. More and higher quality silicon sheets and alloy and structural steels were called for as inputs principally for the machine tool and heavy machinery industries. No important new steel industry capacity or facilities were announced as completed in 1969, despite the relatively large amount of new investment scheduled.

During the year North Korea apparently entered into a technical assistance agreement with Cuba to provide the latter with guidance in making pig iron from iron containing wastes obtained from nickel processing operations.

Analysis of the North Korean mineral industry was made particularly difficult in 1969 because of the adoption, by North Korean sources, of the practice of referring to mines and mineral processing plants by the names of individuals working in them, rather than by their conventional designations. In all but a few cases of the larger steel plants, this made identification impossible.

PRODUCTION

With gross industrial output having increased only 15 percent in 1968 compared with a planned 24 percent gain, no overall economic and few mineral-related goals were announed for 1969. Virtually all reported progress was related to the meet-

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ing of objectives set under the present 7-year plan (1960–67), whose termination has been prolonged to the end of 1970. For the mineral industry these objectives were as follow: For iron ore, 7.2 million tons; for pig iron and granulated iron, 2.2 million tons; for steel ingots, 2.2 million tons; for steel semimanufactures, 1.7 million tons; for cement 4.0 to 4.5 million tons; and for coal, 23 to 25 million tons. No particular mineral sector or commodity was announced as having reached these objectives during 1969, although iron ore apparently did, and the coal sector was declared as having done so in the previous year. Nevertheless, the key Hwanghae integrated steel plant reportedly did meet its particular 7-year-plan goal during the year, as had the Kangson steel plant in 1968.

Table 1.—North Korea: Estimated production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969
METALS			
Cadmium, metal, metric tons	105	105	80
Copper:			
Mine output, metal content	12	12	12
Metal, refined, primary	12	12	12
Gold, mine output, metal content, thousand troy ounces	160	160	160
Iron and steel:			
Iron ore and concentrate	6,500	7,000	7,500
Pig iron [2]	1,750	2,000	2,250
Ferroalloys	45	50	50
Steel, ingots and castings	1,450	1,750	2,000
Steel semimanufactures	1,300	1,500	1,750
Lead:			
Mine output, metal content	65	70	70
Metal, primary	55	55	55
Nickel, metal, primary	1	1	1
Silver, mine output, metal content, thousand troy ounces	700	700	700
Tungsten, mine output, metal content, metric tons	4,500	4,500	4,500
Zinc:			
Mine output, metal content	115	r 120	125
Metal, primary	80	80	60
NONMETALS			
Barite	110	r 120	120
Cement, hydraulic	2,600	2,700	2,800
Fertilizer materials, crude (natural), phosphates (apatite)	250	300	300
Fluorspar, all grades	30	30	30
Graphite, all grades	75	75	75
Magnesite:			
Crude	1,250	r 1,400	1,600
Clinker	600	r 700	700
Pyrite and pyrrhotite (including cupreous) gross weight	500	500	500
Salt, all types	550	550	550
Talc, soapstone, steatite, and pyrophyllite	60	60	60
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite	17,000	18,500	20,100
Bituminous [3]	4,200	4,300	4,700
Other	200	200	200
Total	21,400	23,000	25,000
Coke	1,800	2,000	2,000

r Revised.

[1] Many other mineral commodities are produced but reasonable output estimates cannot be made. These include antimony, beryl, bismuth, chrome, cobalt, manganese ore, mineral sands (ilmenite, zircon, columbite, rutile, monazite), minor and rare metals (selenium, tellurium, germanium, indium, silicon), molybdenite, alum, arsenopyrite, asbestos, boracite, clays, kaolin, lepidolite, limonite, mica (phlogopite), and silica (including glass sands).

[2] Includes Krupp-Renn granulated iron.

[3] Includes low-calorie coal, much of which might be classified as low-rank coal.

TRADE

Minerals and metals again were a very important part of North Korea's 1968 commodity trade. Iron and steel items, a number of nonferrous metals (particularly lead, zinc, cadmium and silver) and various nonmetallics (principally cement, magnesite, magnesia clinker, and talc) remained important export commodities.

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Petroleum products, coke and coking coal, ferroalloys and ferroalloy minerals continued to be priority import items.

North Korea's principal trading partners were the U.S.S.R., Japan and mainland China. For various reasons, much commodity trade—including significant mineral trade—previously carried out with mainland China was conducted in 1968 with the U.S.S.R. Official trade data are not published by North Korea or mainland China. Imports of most minerals and metals of North Korean origin as reported by the U.S.S.R. and Japan and shown in table 2 for 1967-68 are therefore particularly relevant. Recorded exports of these two countries to North Korea are discussed separately below.

Among the minerals and metals reported by the U.S.S.R. as imported from North Korea during 1968, the second year under a 4-year trade agreement, were substantially more zinc concentrate and such nonmetallics as barite, cement, nitrogenous fertilizers and magnesia clinker than those reported in 1967. Exports of U.S.S.R. mineral products to North Korea in 1967 and 1968, in thousand metric tons unless otherwise specified, were as follow:

Commodity	1967	1968
Asbestos	2.4	3.3
Chromite	8.0	10.0
Coal (probably bituminous coking)	15.0	692.0
Coke	72.0	143.0
Fertilizers (potassic)	-----	43.6
Iron and steel:		
Ferroalloys (mostly ferromanganese and ferrochromium)	6.9	6.9
Steel semimanufactures	9.3	8.6
Manganese ore	20.0	19.0
Nonferrous metals and alloys (mostly aluminum)	2.5	2.8
Petroleum refinery products (mostly light and middle distillates) thousand 42-gallon barrels	3,484	6,100
Salt	49.0	53.2
Sulfur	4.8	8.0

The noticeable increases in U.S.S.R. shipments of mineral fuels undoubtedly reflected North Korea's inability to obtain these items from its former main souce of supply, mainland China.

Minerals and metals trade with Japan remained unbalanced in 1968. Imports by that country of North Korean mineral commodities—largely iron and steel items—far outweighted exports of Japanese mineral products to it. A sharp increase in Japanese receipts of North Korean pig iron, ferroalloys and similar materials, however, was somewhat offset by a decrease in receipts of steel semimanufactures. Japanese exports to North Korea, with 1967 quantities in parentheses, included 4,913 metric tons of copper ore and concentrate (none), 200 flasks of mercury (325 flasks), and 7,547 tons of pitch and asphalt (5,006 tons). North Korea also took all 129 tons of Japan's 1968 exports of ferrovanadium (42 tons). In addition, 5,095 tons of other iron and steel products were shipped to North Korea in 1968, compared with 635 tons in 1967.

North Korea maintains a modest but active minerals and metals trade with East and West European countries. In return principally for mineral processing equipment, North Korea usually offers nonmetallic minerals (particularly magnesite) and some nonferrous metals to East Europe, and nonferrous metals to West Europe. Poland, the only East European country besides the U.S.S.R. to report trade in detail, recorded the import from North Korea in 1968 of 82,000 tons of magnesite (24,000 tons in 1967), 2,674 tons of fluorspar (5,549 tons), 504 tons of graphite (40 tons), 6,503 tons of talc (7,009 tons), and 2,575 tons of lead metal (927 tons). In return, Poland exported 52,000 tons of coke (48,000 tons in 1967) as well as a small amount of petroleum products. Special United Nations trade data, available only for 1967, showed that 14,075 tons of zinc metal, 458 tons of lead metal, 224 tons of copper metal and alloys, 114 tons of tungsten concentrate, and an undisclosed quantity of silver valued at approximately $1.2 million were delivered to seven West European countries.

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Table 2.—North Korea: Exports of selected mineral commodities to the U.S.S.R. and Japan

(Metric tons unless otherwise specified)

Commodity	U.S.S.R.		Japan	
	1967	1968	1967	1968
METALS				
Cadmium	r 49	35	30	18
Iron and steel:				
Iron ore	-------	-------	526,418	525,696
Pig iron	55,200	68,400	218,923	267,277
Sponge iron, powder and shot	-------	-------	23,526	31,313
Ferrosilicon	1,200	2,000	1,541	297
Steel, primary forms and semimanufactures	79,700	82,300	51,102	26,965
Lead and alloys, all forms	17,000	19,100	617	1,590
Silver thousand troy ounces	-------	-------	885	1,276
Zinc:				
Concentrate	2,300	18,100	2,209	7,164
Metal and alloys, all forms	7,700	4,600	2,420	3,852
NONMETALS				
Barite	69,600	88,900	-------	-------
Cement	256,000	295,000	-------	-------
Fertilizers, manufactured, nitrogenous	10,200	30,600	-------	-------
Fluorspar	-------	-------	5,562	14,041
Graphite (mostly amorphous)	-------	-------	6,429	12,620
Magnesia clinker	158,900	211,300	18,261	12,555
Nonmetallic slag	-------	-------	14,233	16,914
Soapstone and talc (mostly talc)	27,400	28,700	4,092	10,013
MINERAL FUELS AND RELATED MATERIALS				
Anthracite	-------	-------	102,591	104,025

r Revised.
Source: Derived from official import statistics of the U.S.S.R. and Japan.

COMMODITY REVIEW

METALS

Iron Ore and Steel.—Despite a lack of specific references to iron ore mining in 1969, the apparent increase in pig iron production during the year indicated a rise in ore output. Deliveries to Japan of 59-percent-iron ore from Musan, the country's leading iron ore mine, totaled 535,000 tons—somewhat more than in 1968.

At midyear, outputs of crude and rolled steel at the integrated Hwanghae plant, located south of P'yongyang, had risen so sharply that the claim was advanced that the plant had reached the production levels envisaged for it in the 7-year plan. Yearend results indicated increases over 1968 levels of 14 percent in crude steel and 17 percent in rolled steel, as well as a 13-percent rise in pig iron. The principal factor in these successes appeared to be reductions, by as much as 2 hours, in the average heat times of the six open-hearth furnaces. Shorter heat times (in electric-arc furnaces) were also apparently responsible for further production increases at Kangson, situated west of P'yongyang, which reportedly had met its 7-year plan targets in 1968. Construction work presumably continued on the Krupp-Renn rotary furnaces being added to give Kangson a pig iron capability. An absence of reporting on Kimchaek on the eastern coast, presumably the only other integrated plant, indicated few if any significant gains had been made here. The status of an oxygen converter shop previously reported as being built at Kimchaek was unclear.

Nonferrous Metals.—Virtually no direct information was available on the status of North Korea's nonferrous mines and smelters in 1969. The increase of nearly 66,000 tons in zinc concentrate exports to Japan (to 73,000 tons) accompanied by a nearly 50-percent decrease in cadmium shipments there, seemed to indicate that some sort of repair or renovation activity was taking place at either the Munpyong lead-zinc plant on the eastern coast or the Nampo zinc-copper installation on the western coast.

NONMETALS

Cement.—A significant increase in production was claimed during the first half of the year. Most of the rise appeared to be in the form of improved operation of

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existing kilns and facilities rather than in plant capacity additions. Madong remained the largest of the six known major North Korean cement plants, followed by Sunghori and Haeju. The country's total annual cement capacity probably stayed about 3 million tons.

Fertilizer Materials.—Total output of manufactured fertilizers apparently rose about 15 percent in 1969. Although no progress was reported on a number of plant expansion programs initiated in previous years, production evidently increased at the important Hungnam fertilizer complex on the eastern coast. Favorable mention was made concerning output from the anthracite-gasification and urea-making shops of the nitrogen fertilizer plant there. Renovation of existing raw material processing equipment and "production processes" was credited with increasing output at one of North Korea's several other nitrogenous fertilizer plants.

No information was available on the relative success of programs to expand production of domestic apatite for the making of phosphatic fertilizers. At least 10,000 tons of phosphate rock were imported from the United Arab Republic in 1969.

Magnesite.—Little information was available on output of magnesite, an important export item for the country. New machinery and mining methods reportedly were introduced very successfully at one mine, but the identity and scale of operations at the mine were not disclosed. By far the most important mine producer of North Korea's magnesite, most of which is located in the Machon Mountain Range of northeastern North Korea, was Youngyang in South Hamyong Province.

Exports of magnesite went principally to Poland and shipments of magnesia clinker went largely to the U.S.S.R. Japan also was a recipient of 19,167 tons of clinker of 1969.

MINERAL FUELS

Coal.—Along with increases in output, substantial successes were claimed in tunneling for developing new reserves and in preparing faces for future extraction. A significant amount of new equipment (particularly metal props) and machinery of various types was alleged to have been introduced. In South Pyongan Province, the source of most of North Korea's coal, special mention was made of the installation of a coal plough in one mine and of a "long wall blasting" system of excavation in another. Reportedly, output from North Hamyong Province, which produces badly needed higher grade bituminous coal, rose substantially again in 1969 after having achieved 7-year-plan targets the previous year. During the year it was stated that "small and medium" scale mines now accounted for 30 percent of all production.

Petroleum.—Design and site preparation work presumably continued on the 40,000-barrel-per-day U.S.S.R.-sponsored refinery scheduled for erection at Sinuiju in North Pyongan Province. Meanwhile, North Korea imported the bulk of its 1969 petroleum product needs from the U.S.S.R. Under an agreement signed in November with the United Arab Republic, refinery products were to be imported from that country in 1970.

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The Mineral Industry of South Korea

By R. A. Pense [1]

South Korea had in 1969 a modest but growing mineral industry strongly supported by foreign (mostly United States and Japanese) investment and assistance. Although significant amounts of anthracite, tungsten, bismuth, fluorspar, graphite, and talc–soapstone–pyrophyllite were produced, the mineral base remained limited, especially when compared with that of the more industrialized North Korea. Most mineral processing industries—chiefly cement and fertilizer production, and petroleum refining—have expanded notably in recent years and surpassed their North Korean counterparts.

Substantial economic progress was made again in 1969, the third year of the second 5-year plan (1967–71). The gross national product (GNP) was preliminarily estimated at $4,822 million (1965 constant prices), representing a real increase of 15.5 percent over the 1968 GNP. This exceeded even the 13.3-percent rise of 1968 and more than doubled the average 7-percent-per-year growth rate originally set for the plan. Manufacturing, including the very important cementmaking, fertilizer-producing, and petroleum-refining sectors, made a significant contribution towards 1969 growth. Mining and quarrying provided a preliminarily estimated added value of $63 million (in constant prices) to the economy, or about 1.3 percent of 1969 GNP.

The industrial index for mining fell from 99.1 in 1968 to 96.8 (1965=100). Indexes of the major identified components of mining and mineral processing, on the same base year, follows:

	1968	1969
Coal mining	93.2	88.5
Metallic mining	117.7	115.5
Nonmetallic mining	69.0	98.2
Petroleum and coal processing	199.1	257.9
Nonmetallic processing (including cement)	163.3	201.7
Base-metal processing	229.6	282.2
Metal processing	248.1	228.0

The most ambitious industrial project of the second 5-year plan, a conventional integrated iron and steel plant at Pohang in the southeast, made slow progress in 1969. In the first half of the year both the International Economic Consultative Organization for Korea and the Export-Import Bank of the United States declined to provide the foreign exchange needed to begin building on the general basis of the project's doubtful economic viability. As a result, the South Korean Government's tentative construction agreement with Korea International Steel Associates, an international consortium of companies headed by Koppers Co. Inc., of Pittsburgh, lapsed.

Japanese assistance was then sought and evidently obtained in early December. Of the $224 million now estimated as necessary for completion of a 1-million-ton-per-year plant, about $124 million was to come from Japanese sources. Approximately $87 million of this was to be in the form of loans and grants under a Japanese-South Korean World War II reparations agreement, and about $37 million was to be in loans from the Japan Export-Import Bank. Technical assistance for the project was to be provided by three major Japanese steel concerns. Construction of first stage facilities was tentatively scheduled to begin in 1970 and be completed in 1973.

New laws improving investment opportunities in the steel and petrochemical industries were reportedly passed, apparently in an effort to hasten development in these sectors. While this legislation may already have been of some use in moving the integrated steel plant ahead, it was particularly needed to expedite the Ulsan petrochemical complex project. Reportedly, continuing financing difficulties were being

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encountered, although letters of intent had been signed for the building of a number of the elements of the Ulsan complex.

In October M. W. Kellogg Co. was appointed managing contractor for a naphtha-cracking plant, the key facility in the Ulsan complex. Feedstock for the plant, which is to produce 150,000 tons of ethylene annually, is to come from an existing adjacent refinery. Both the refinery and the naphtha cracker are owned by Korea Oil Corp. (KOC). Gulf Oil Corp., a minority partner in KOC, is loaning money for the cracking unit.

Legislation was also introduced and apparently approved concerning the development of offshore minerals. Prospecting rights are limited initially to 10 years and exploitation rights to 30 years. The Minister of Commerce and Industry, who administers the Law, may extend these periods in 5-year increments. Corporate taxes are limited to 50 percent of taxable income. Normal taxes and duties are waived for imports of materials needed by prospectors and exploiters. Losses can be deducted from taxable income for up to 10 years. Presumably, the three offshore petroleum exploration agreements concluded in 1969 or under negotiation at yearend conformed with the new legislation.

PRODUCTION

Anthracite, still by far the most important crude mineral produced, apparently accounted in 1969—for the first time in at least 15 years—for less than one-half of the estimated gross output value of the mining sector. In terms of current prices, anthracite value was estimated at $80 million, only 47 percent of the total estimated mining value of $170 million. Other significant mine production values were contributed by tungsten ($13 million), iron ore ($8 million), and limestone ($20 million).

Output of most crude nonmetallic minerals increased because of favorable conditions in the Japanese markets, for which they are produced to a considerable extent. In spite of high prices and growing Japanese demand, production of fluorspar, of which South Korea is a significant world producer, declined sharply. This was mainly because of a lack of suitable ore. Limestone output rose steeply because of increased demand by the domestic cement industry.

In minerals processing, increasing demand from indigenous—and to a lesser extent, foreign—consumers was basically responsible for substantial increases in volume outputs from the important sectors of crude steelmaking (up 40 percent), cement manufacturing (up 36 percent), and petroleum refining (up 62 percent). The midyear entry into operation of a second refinery, increasing national refining capacity by somewhat more than one-half, was a more immediate factor in boosting petroleum-product production.

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Table 1.—South Korea: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Aluminum, metal, primary	----	----	6,309
Antimony, mine output, metal content	66	31	NA
Beryllium, beryl concentrate, gross weight	2,440	3,572	----
Bismuth, metal	110	r104	115
Copper:			
Mine output, metal content	1,400	1,201	1,330
Metal, refined, including secondary	3,698	4,556	6,220
Gold, metal [1] troy ounces	63,337	62,405	50,784
Iron and steel:			
Iron ore and concentrate thousand tons	698	880	710
Pig iron do	r33	r46	e41
Ferroalloys [2]	7,037	5,891	e11,000
Steel, ingots and castings thousand tons	320	r372	521
Lead:			
Mine output, metal content	9,684	17,265	16,477
Metal	2,987	3,119	3,478
Manganese, ore and concentrate, gross weight	7,241	4,221	2,902
Molybdenum, mine output, metal content	279	192	130
Silver, metal thousand troy ounces	588	611	906
Tin, mine output, metal content long tons	40	44	NA
Tungsten, mine output, metal content	2,025	2,092	1,971
Zinc:			
Mine output, metal content	18,649	19,840	22,082
Metal, primary	2,548	2,454	2,810
NONMETALS			
Asbestos	2,166	3,311	NA
Barite	----	5	NA
Cement, hydraulic thousand tons	2,440	3,572	4,865
Clays, kaolin do	103	121	136
Diatomite	2,238	2,214	2,916
Feldspar thousand tons	17	21	23
Fluorspar, all grades do	57	47	39
Graphite:			
Crystalline	2,426	1,788	920
Amorphous thousand tons	61	128	73
Pyrite and pyrrhotite (including cupreous):			
Gross weight	4,411	NA	NA
Sulfur content e	1,470	NA	NA
Salt, marine thousand tons	612	561	289
Stone, sand and gravel, n.e.s.:			
Crushed and broken limestone do	3,916	5,653	7,415
Stone, not further described do	229	178	226
Sand (including glass sand) do	44	49	87
Talc and related materials:			
Pyrophyllite do	67	78	101
Talc do	56	72	84
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	NA	----	454
Coal, anthracite thousand tons	12,436	10,242	10,273
Fuel briquets, anthracite briquets do	e8,500	6,891	9,194
Peat do	31	r8	NA
Petroleum refinery products:			
Gasoline and naphthas:			
Motor gasoline thousand 42-gallon barrels	2,690	3,938	7,410
Naphthas do	492	1,528	4,264
Kerosine and jet fuel:			
Kerosine do	1,366	1,975	2,220
Jet fuel do	842	1,962	3,126
Distillate fuel oils do	4,083	r10,082	9,603
Residual fuel oil do	7,272	r13,861	26,735
Liquefied petroleum gas do	107	182	396
Other, including unspecified do	272	r2,062	3,868

e Estimate. r Revised. NA Not available.

[1] Officially reported production only.

[2] Mostly ferrosilicon and ferromanganese.

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TRADE

The value of major mineral exports rose in 1969 principally because of greater shipments abroad of steel plates and sheets. The most important single mineral export items, however, were ores of tungsten ($12.4 million) and iron ($6.1 million).

Larger imports in 1969 of iron and steel scrap and semimanufactured products and of petroleum were mainly responsible for the significant increase in the value of the major mineral imports. The scrap, coming largely from the United States, went to satisfy the raw-material demand of the steel industry's expanding crude-steel sector; this still consists largely of scrap-based, electric-arc furnaces. The rolling sector of the steel industry needed greater quantities of semifinished products, originating mostly in Japan, to produce more sheets, plates, and pipes. Petroleum imports, consisting principally of crude oil, increased markedly with the coming on stream near midyear of a new refinery.

Fuller operation of several fertilizer plants completed in recent years led to another big drop in purchases of foreign-manufactured fertilizers in 1969. Concomitantly, imports of crude-fertilizer materials increased. The following tabulation shows the trends and changes in the major components of mineral trade 1967–69:

	Value (million dollars)		
	1967	1968	1969 p
EXPORTS			
Metallic ores (mostly tungsten and iron)	21.6	25.7	26.4
Nonmetallic ores	5.8	6.3	7.4
Iron and steel products	1.9	r1.2	4.9
Anthracite	1.8	2.2	2.7
Total	31.1	r35.4	41.4
IMPORTS			
Iron and steel scrap	18.9	22.9	40.3
Crude fertilizer materials (including sulfur)	2.9	10.0	14.8
Manufactured fertilizers	43.9	30.5	11.9
Iron and steel products	56.1	69.2	84.5
Nonferrous metals	12.5	r16.1	18.5
Nonmetallic products	10.1	4.7	2.7
Petroleum and products	59.4	85.0	107.6
Total	203.8	r288.4	280.3

p Preliminary. r Revised.

Table 2.—South Korea: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Bismuth metal, including alloys, all forms	99	75
Iron and steel:		
Iron ore and concentrate thousand tons	668	772
Metal powders	1,400	6,580
Semimanufactures thousand tons	10	NA
Lead ore and concentrate	12,821	19,930
Manganese ore and concentrate	367	500
Molybdenum ore and concentrate	514	509
Rare-earth metals, ore and concentrates	102	----
Silver metal, including alloys, all forms thousand troy ounces	225	418
Tin ore and concentrate long tons	36	2
Tungsten:		
Ore and concentrate	3,990	3,619
Metal, including alloys, all forms	12	----
Zinc ore and concentrate	22,319	34,075
NONMETALS		
Abrasives, flint pebbles	12,443	8,227
Cement	5,315	17,500
Clay and clay products:		
Crude clays, n.e.s., kaolin	26,358	39,608
Products, refractory	47,287	59,860
Diatomite and other infusorial earths	307	60
Feldspar and related materials:		
Feldspar	2,710	6,767
Leucite, nepheline, and nepheline syenite	25,572	28,801
Fluorspar	48,182	49,733
Graphite, natural	51,231	48,037
Mica, all forms	592	3,461
Stone, sand and gravel:		
Dolomite, chiefly refractory grade thousand tons	12	11
Gravel and crushed rock do.	13	1
Quartz and quartzite do.	97	72
Talc and soapstone do.	58	49
MINERAL FUELS AND RELATED MATERIALS		
Coal and briquets, anthracite thousand tons	172	226
Petroleum refinery products, asphalt thousand 42-gallon barrels	----	8

NA Not available.

Source: Foreign Trade of Korea, 1967 and 1968. Customs Bureau, Ministry of Finance.

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Major destinations of selected commodities, 1968

(Thousand metric tons unless otherwise specified)

Commodity	Quantity
Bismuth metal, including alloys, all forms ---- metric tons	75
Belgium ---- do	40
United Kingdom ---- do	30
Iron and steel, iron ore and concentrate	772
Japan	742
Lead ore and concentrate	20
Japan	20
Molybdenum ore and concentrate ---- metric tons	509
Japan ---- do	267
West Germany ---- do	105
Silver metal, including alloys, all forms ---- thousand troy ounces	418
United Kingdom ---- do	225
Japan ---- do	193
Tungsten ore and concentrate ---- metric tons	3,619
Japan ---- do	1,144
West Germany ---- do	984
Zinc ore and concentrate	34
Japan	34
Clay and clay products, crude clays, n.e.s., kaolin	40
Japan	40
Fluorspar	50
Japan	49
Graphite, natural	48
Japan	42
Talc and soapstone	49
Japan	38
Coal and briquets: Anthracite	226
Japan	216

Table 3.—South Korea: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, all forms	12,394	15,404
Copper:		
Ore and concentrate	----	6,786
Metal and alloys, all forms	3,466	3,475
Iron and steel, metal:		
Scrap ---- thousand tons	318	391
Pig iron ---- do	46	79
Spiegeleisen	3,000	14
Steel, primary forms ---- thousand tons	42	NA
Semimanufactures ---- do	318	232
Lead, metal, including alloys, all forms	1,260	2,706
Manganese:		
Ore and concentrate	7,197	521
Oxides	452	242
Mercury ---- 76-pound flasks	323	2
Tin, metal, including alloys, all forms ---- long tons	201	280
Titanium:		
Ore and concentrate	287	----
Oxides	2,144	3,157
Zinc, metal, including alloys, all forms	4,645	6,780

See footnotes at end of table.

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Table 3.—South Korea: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
NONMETALS			
Asbestos	thousand tons	22	25
Cement	do	468	142
Corundum, manufactured		877	886
Diatomite and other infusorial earths		60	157
Fertilizer materials:			
Crude:			
Phosphatic	thousand tons	48	371
Potassic	do	122	----
Manufactured:			
Nitrogenous	do	281	420
Phosphatic	do	312	140
Potassic	do	29	68
Others	do	5	15
Gypsum	do	82	101
Sodium and potassium compounds, soda ash	do	33	23
Sulfur, elemental, all forms	do	37	55
MINERAL FUELS AND RELATED MATERIALS			
Carbon black		4,254	4,875
Coal, all grades, including briquets		r 58	53
Coke and semicoke		32	51
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	18,371	37,199
Refinery products:			
Gasoline	do	350	20
Naphtha	do	92	143
Kerosine	do	367	162
Distillate fuel oil	do	513	140
Residual fuel oil	do	5,835	3,196
Other	do	NA	145

r Revised. NA Not available.

Source: Foreign Trade of Korea, 1967 and 1968. Customs Bureau, Ministry of Finance.

Major origins of selected commodities, 1968

(Thousand metric tons unless otherwise specified)

Commodity		Quantity
Aluminum, metal, including alloys, all forms		15
United States		11
Copper ore and concentrate		7
Philippines		4
Japan		3
Copper, metal and alloys, all forms	metric tons	3,475
United States	do	2,782
Iron and steel metal, scrap		391
United States		341
Iron and steel, metal, semimanufactures		232
Japan		209
Zinc, metal, including alloys all forms		7
Japan		6
Asbestos		25
Canada		16
United States		7
Cement		142
Japan		142
Fertilizer materials, crude, phosphatic		371
United States		368
Fertilizer materials, manufactured, nitrogenous		420
Japan		405
Fertilizer materials, manufactured, phosphatic		140
United States		140
Gypsum		101
Mexico		92
Sulfur, elemental, all forms		55
Canada		50
Coke and semicoke	metric tons	51
Japan	do	51
Petroleum, crude and partly refined	thousand 42-gallon barrels	37,199
Mainly from Iran and Kuwait	do	37,199

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COMMODITY REVIEW

METALS

Aluminum.—The country's first primary aluminum plant, a 15,000-ton-per-year refinery of the Korean Aluminum Company, came on stream in June at Ulsan. Technical assistance in construction was given by Showa Denko Co., Ltd., of Japan, which provides the alumina feedstock. Approximately 3,000 ingot tons of aluminum, valued at $1.6 million, had been shipped to Japan by yearend. Additional facilities at Ulsan include a 3,000-ton-per-year extrusion press.

Copper, Lead, Silver, and Gold.—The Changhang custom smelter and refinery remained the key nonferrous installation, producing 5,221 tons of copper and 3,478 tons of lead, as well as significant portions of the domestic gold and silver output. Concentrates from the Philippines and Canada and scrap provided a substantial portion of the raw material for copper. Denationalization of Changhang, operated by the Government's Korea Mining and Smelting Corp., was reportedly decided upon during the year.

Indications of a major native copper discovery in Kyongsang-Pukto Province were reportedly not substantiated by later diamond-drilling. The most important source of the 22,167 tons of low-grade copper concentrate produced indigenously was the Kunbuk copper mine with 3,266 tons. An estimated 70 percent of the 32,953 tons of lead concentrate produced was from the Yeong Hwa lead-zinc mine of Young Poong Mining Company, Ltd. Most if not all of Yeong Hwa's lead output was shipped to Japan. Production of silver increased by nearly one-half because of the opening in August of Young Poong's new Bupyong silver-lead mine at Inchon. Indicated reserves were reported as 2 million tons of ore containing 330 grams per metric ton of silver and 2.5 percent lead. Equipped with a flotation mill capable of handling 400 tons of ore daily, Bupyong produced 287,000 ounces of silver by yearend.

Iron Ore.—Production, geared largely to supplying Japanese demand, declined significantly principally because of falling Japanese market prices. The largest output (309,000 tons) came from the Yangyang mine of the recently denationalized Daihan Iron Mining Corp. The Chungju mine of Young Poong produced 170,000 tons, but reserves reportedly were virtually exhausted. Output at the Mulkum mine of Taehung Mining Co. declined 37 percent to 130,000 tons because of its owner's financial difficulties.

Iron and Steel.—At midyear the iron and steel industry consisted principally of several companies with a total maximum annual capacity of about 200,000 tons of pig iron in small blast and electric-arc furnaces and a rotary kiln; approximately 15 concerns with a total annual capacity of about 800,00 tons of steel ingots from electric-arc furnaces, Bessemer converters, and open hearths; and about 40 enterprises with an annual rolling capacity of slightly over 1 million tons engaged mainly in producing reinforcing rods. Much of the steelmaking equipment, which dates from before World War II, and the rolling mills, which were established during the 1950's, are reportedly uneconomically small and now outmoded. Total employment in the industry was estimated at 20,000.

At yearend the projected new integrated steel plant at Pohang was scheduled to receive its one blast furnace, with an internal working capacity of 1,600 cubic meters, and two converters. Other facilities, including continuous-casting equipment and a hot-strip mill, were apparently to be added later.

Tungsten.—The long-run decline in national output resumed in 1969 as Sangdong —the world's largest producer—produced only 3,061 metric tons of scheelite concentrate, 19 percent less than the previous year. The program for developing deeper, lowergrade ore at Sangdong had not yet been completed at yearend. Rapidly rising world prices, however, stimulated the reopening of the Il Kwang copper-tungsten mine to develop an estimated 100,000 tons 0.6 percent tungsten ore.

Zinc.—Yeong Hwa was again by far the largest producer of the 41,163 tons of zinc concentrate. Ulchin (7,631 tons) and Sinyemi (3,936 tons) were much smaller but still significant mine sources. Virtually all of Yeong Hwa's output was shipped to Japan for metallurgical processing, but a 7,700-ton-per-year refinery was under construction at pithead for completion in 1970. In addition, sufficient reserves had

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been developed by Young Poong nearby to justify the building of a 1,000-ton-per day ore flotation mill, four times the size of the existing mill.

All refined zinc was produced in 1969 by the small custom refinery of Tongshin Industries Ltd. near Seoul, which operated at about one-half capacity. Reportedly, capacity was raised to 6,000 tons annually near yearend, apparently in anticipation of increased ore supplies.

NONMETALS

Cement.—Greater utilization of capacity built the previous year was apparently primarily responsible for a 36-percent increase in production and the movement of the country in 1969 into the position of a net exporters. The only identified plant addition involved the doubling of the Tanyang facility of Hyun Dai Construction Co. to 400,000 tons annually near the beginning of the year.

Sulfur.—Most of the country's growing demand for sulfur, all of which has been imported, is used in the production of sulfuric acid for the manufacture of fertilizers. In 1969, two mixed fertilizer plants—the Ulsan plant of Yong Nam Chemical Fertilizer Co., Ltd. and the Chinhae plant of Chinhae Chemical Co., Ltd.—contained roughly 90 percent of the national sulfuric acid production capacity of about 400,000 tons annually. The remaining acid production capacity was accounted for by 12 small producers. In addition, a 50-ton-per-day acid plant based on sulfur recovery from stack gases was to have been erected before yearend at the Changhang smelter and refinery. Nonacid sulfur consumption, estimated at 6,000 tons in 1969, went for rubber manufacturing (50 percent), papermaking (25 percent), and carbon disulfide production (25 percent).

MINERAL FUELS

Coal.—Production stabilized in 1969, apparently benefiting from such Government relief measures (adopted the previous year) as the extension of $7.4 million in potential new loan money for mine development; the initiation of improvements on mine-to-consumer transportation facilities; the raising of the Government's Daihan Coal Corp. (DCC) capitalization from roughly $15 million to $37 million; and a 25-percent increase in coal sales prices. Output at midyear from DCC's Changsong mine, the country's largest and a recipient of extensive U.S. assistance, seemed to indicate production would reach 2 million tons by yearend. This would be about the same as production in 1968, but below the 2.4 million tons targeted.

Petroleum.—In April, Gulf Oil Corp. became the first international oil company to reach agreement with the Government on exploration of the country's continental shelf. If the projected three-phase investigation program is carried out, Gulf—operating through its wholly owned South Korean subsidiary, Gulf Oil Corp. of Korea—will spend a minimum of $8 million over a maximum of 8 years in exploring about 27,000 square miles in two discontiguous blocks off the west coast. Gradual relinquishment of 75 percent of Gulf's concession area during exploration was provided for. If production proves feasible, exploitation rights are guaranteed for at least 30 years. Initial royalty would be set at 12.5 percent, with taxes limited to a 50-percent corporate levy on net profits. By yearend Gulf had completed its seismic survey work, while subsidiaries of Royal Dutch/Shell and California Texas Oil Corp. were negotiating similar agreements for other roughly equal-size offshore concessions to the west and south.

The most important development in petroleum processing was the midyear start-up of Honam Oil Refining Co., Ltd's, new refinery at Yosu on the southern coast. A joint venture of Lucky Chemical Co. of South Korea and California Texas Oil Corp. of the United States, the 65,000-barrel-per-day plant also has 9,500-barrel unifining and 5,600-barrel reforming units. Included in the estimated 10.7 million barrels of products produced during the year was an estimated 600,000 barrels of naphtha shipped to Japan under a short-term contract. At the other operating refinery, the 115,000-barrel-per-day Ulsan plant of KOC, which ran at full capacity throughout the year, 11,000 barrels of catalytic reforming capacity was reportedly being added to the existing 6,800 barrels. While international financing was still being sought, site work began for a 50,000-barrel-per-day topping unit at Inchon. A joint venture of the Government and Union Oil Corp., the output of the facility is reportedly to go partly to an associated power-plant in the form of fuel oil and partly for export (probably to Japan) as naphtha.

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The Mineral Industry of Kuwait, Kuwait-Saudi Arabia Neutral Zone and Saudi Arabia

By David A. Carleton [1]

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KUWAIT

The petroleum industry, which is the bulwark of Kuwait's economy has again expanded operations. Crude oil production (excluding Kuwait's share of production in the Kuwait-Saudi Arabia Neutral Zone) increased 6 percent during 1968, a rate unchanged from that of 1968 but somewhat higher than that of the general economy during 1969. Payments to the United Arab Republic and Jordan, which amount to the equivalent of about $180 million annually or (nearly 25 percent of Government income) has been a major cause for the relative slowdown in domestic development.

Income from petroleum production, refining, and exports contribute about 50 percent to the gross national product and more than 90 percent to Government income. These revenues, which amounted to $670 million in 1968 and about $700 million in 1969, have enabled Kuwait to build an impressive social and economic infrastructure, import skills from abroad, and accumulate extensive external financial reserves. Petroleum revenues, however, have led to an imbalanced economy, reflected in the disproportionate relationship between the economic factors of production; land, labor, and capital. Other mineral operations are limited to the production of nonmetallic construction materials. Efforts to diversify the economy have met with great obstacles, primarily because of the extreme shortage of natural resources other than petroleum and natural gas, the limited areal extent of Kuwait, and the country's narrow domestic market.

The results of the Government's first geological survey were reevaluated during the year. It was decided to follow through with detailed surveys covering surface and underground minerals resources other than oil. A French firm has been contracted to perform the surveys, to be completed by mid-1970.

The Industrial Law of 1965 called for expansion of small manufacturing plants and public assistance to small industries. It also created the Shuaiba Industrial Development Board to study likely industry projects. To date, the scope of industrial investment has been limited. The largest mineral industry investments other than those of the petroleum industry have been in a fertilizer plant, a company for manufacturing oil well drilling muds, and in plans for a petrochemical industry for making plastics and raw materials for export. The drilling mud plant imports raw materials from Iran and was set up by a subsidiary of Dresser Industries, Inc., (a U.S. firm) and a Kuwaiti group.

The only nonpetroleum mineral industry which predates the Industrial Law of 1965 is a brick plant built in 1956 by the Kuwait Sand Lime Brick Co. The plant was acquired in 1960 by National Industries

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Co., a mixed-capital firm. In 1961, it broadened its scope to include cement products and, more recently, asbestos cement and spiral-wild steel pipe.

Major petroleum facilities other than crude oil producing and handling equipment are three petroleum refineries; the Mina al Ahmadi plant, owned by Kuwait Oil Co. Ltd. (KOC), Shuaiba plant of Kuwait National Petroleum Co. (KNPC) and the Mina Abdullah plant, American Independent Oil Co. (Aminoil).

In addition to the expansion of petroleum facilities, the first 5-year development plan, 1967–68 through 1971–72 calls for industrial expansion at Shuaiba, as well as construction of an asphalt facility, a chlorine plant, aluminum plant, and cement pipe works. Most of these will be financed by either private or joint public-private sources.

PRODUCTION

Crude oil production by KOC the sole producing company in Kuwait proper, averaged 2,575,455 barrels daily in 1969, about 6 percent above the 1968 level. Refinery throughput averaged 400,000 barrels per day that year. Marketed natural gas totaled 129,273 million cubic feet, two-thirds of which was used as fuel by KOC.

Minor mineral commodities produced in 1969 were 46 million sand-lime bricks, 694 tons of hydrated and quick-lime, 4,000 tons of evaporated salt, and 14,786 tons of sulfur recovered from the Mina Abdullah refinery of Aminoil. Data on sulfur recovered from the Shuaiba refinery of KNPC are not available. In 1968 (latest data available), petrochemical production totaled 199,169 tons, of which 103,705 tons were urea and 95,464 tons were ammonia sulfate.

Table 1.—Kuwait: Production of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1967	1968	1969
Crude petroleum	836,719	886,125	940,041
Petroleum refinery products:[1]			
Motor gasoline	2,678	4,209	7,053
Jet fuel	393	411	635
Kerosine	363	1,287	3,674
Distillate fuel oil	18,530	48,380	46,930
Residual fuel oil	60,410	47,969	50,627
Liquefied petroleum gas[2]	8,591	16,829	17,163
Other refinery products	19,490	6,437	4,843
Total	110,450	125,522	130,925
Refinery fuel and loss	1,116	1,509	1,379

[1] Includes output from KOC, Aminoil, and KNPC refineries
[2] Includes production of natural gas process plant.

TRADE

Kuwait in 1969, ranked fifth among the major petroleum exporting countries of the world, the same as in 1968. Most of the petroleum exports are by the KOC owners, British Petroleum Co. Ltd., and Gulf Oil Corp. Since the completion of Shuaiba refinery, KNPC has been an exporter. The latter has experienced difficulty meeting its export commitments because of the Suez Canal closure. Officials of the company have been pursuing talks with U.S.S.R. officials for the exchange of refined petroleum products for their respective customers east and west of the closed canal. Under the proposal, KNPC will suppply products from the Shuaiba refinery to the Russians to meet their sales commitments in India and other Indian Ocean areas; the Russians will supply products to KNPC for its contracts in Northern Europe. KNPC's principal contract in Europe is to supply 1 million tons annually of products (largely distillate fuel oil) to West Germany. Part of this contract is now being supplied by a swap with the Compagnie Française des Pétroles for about 200,000 tons of distillate fuel oil annually. In addition, Rumanian officials have proposed a $100 million barter arrangement, under which Kuwait would export refined petroleum products and petrochemicals in exchange for Rumanian goods, mainly oil equipment.

Bunkers of vessels and aircraft engaged in international trade in 1968 was as follows in thousands of barrels: aviation gasoline 14; jet fuel 265; distillate fuel oil, 10,351; and residual fuel oil 19,939.

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Table 2.—Kuwait: Exports of crude petroleum and petroleum refinery products
(Thousand 42-gallon barrels)

Commodity	1967	1968	1969
Crude petroleum	755,208	792,421	[1] 835,575
Petroleum refinery products:			
Gasoline	899	1,422	4,232
Kerosine	48	860	3,157
Jet fuel	------	258	
Light distillate, unfinished	16,031	36,024	36,255
Distillate fuel oil	16,912		
Residual fuel oil	34,482	23,212	29,110
Other	330	6,341	5,969
Total	68,202	68,117	78,723
Liquefied petroleum gas [2]	11,409	15,891	12,097

[1] Major destinations were (in million 42-gallon barrels): the United Kingdom, 144.5; Italy, 109.1; Netherlands, 99.5; Japan, 90.0; France, 69.8; Ireland, 60.5; Singapore, 34.7; and Belgium 31.7. Of total crude oil exports 64.2 percent went to Europe and 28.4 percent to the Far East and Oceania.
[2] Propane, butane, and natural gasoline from natural gas process plants.

Table 3.—Kuwait: Imports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum and alloys [1]	583	1,299
Copper and alloys [1]	298	198
Iron and steel:		
Scrap and unwrought	1,845	26,123
Semimanufactures	191,066	245,668
Lead and alloys [1]	150	311
NONMETALS		
Asbestos sheets	3,065	2,364
Barite compounds	26,975	34,132
Cement	729,123	1,048,588
Diamond, carats	------	905
Gypsum and limestone	8,308	11,171
Marble	7,382	4,484
Salt	1,400	1,074
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	216	377
Crude petroleum, thousand 42-gallon barrels	25,273	22,138
Petroleum refinery products:		
Gasoline, do.	15	14
Liquefied petroleum gas, do.	251	363
Lubricants, do.	104	126
Asphalt, do.	28	67
Total, do.	398	570

[1] Sheets, bars, and pipes.

COMMODITY REVIEW

Metals.—*Aluminum.*—Joint-venture negotiations were undertaken in 1969 between the Government of Kuwait and the Ethyl Corporation (a U.S. firm) for the construction of a $100 million aluminum reduction plant in Kuwait. The proposed plant would import alumina from Australia and produce aluminum by electrolysis. Major points of the negotiation yet to be resolved are the electricity costs and financial participation.

Nonmetals.—*Fertilizer Materials.*—Fertilizers are produced at the Shuaiba plant of the Kuwait Chemical Fertilizer Co. (KCFC), which uses natural gas from nearby oilfields as the basic raw material. The plant has a capacity to produce 400 tons per day of ammonia with other units for the production of urea, 550 tons per day; sulfuric acid, 400 tons per day; and ammonia sulfate, 500 tons per day.

This first plant will be joined by a new $80 million KCFC complex at Shuaiba due for completion in 1970. Capacities will be 1,600 tons per day of ammonia, one half of which will be converted to urea in a 1,400-ton-per-day unit. German and Japanese firms are building the principal units.

During 1969, KCFC announced the conclusion of two contracts calling for the

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supply of $5.0 million worth of urea to Pakistan and $3.7 million worth to India. In Pakistan it was announced that 70,000 tons of nitrogen fertilizer would be received from Kuwait. The transaction with India stipulates the barter of urea in return for an equal value of jute sacks, which KCFC will use directly in its bagging operations.

Mineral Fuels and Related Materials.—*Petroleum and Natural Gas.*—Although KOC (the only crude oil producing company in the country) showed fairly even growth during 1968, production in 1969 was distorted by uneven monthly offtake by the parent companies. In order to meet a commitment to the Government to attain a 6-percent increase over 1968 production, the KOC increased output during the last 2 months to about 2.9 million barrels daily.

The major accomplishment of KOC during 1969 was the completion of a 77-mile, 30/36-inch pipeline system between the northern fields and the Ahmadi tank farm. The right-of-way parallels the existing 30-inch line. When branch lines, gathering centers, and ancillary facilities are completed in early 1970, the total rated capacity of the line will be 500,000 barrels daily, raising the maximum throughput capacity at Ahmadi to 3.7 million barrels per day. These new additions to KOC's production facilities are among several projects in a development program initiated in 1968 and for which a new coordinating organizational unit was set up called the Crude Oil Production Expansion (COPE). The program includes three gathering centers in the northern fields, four gathering centers in the Burgan-Ahmadi area, and five huge storage tanks each with a capacity of 600,000 barrels near Mina al Ahmadi.

KOC completed an exploration survey of Kuwait Bay and the southern half of Bubiyan Island; on November 30, 1969, Bubiyan No. 2 was the first exploration well drilled on the island since 1963.

Although KNPC's Shuaiba refinery was completed during 1968, the plant was plagued with operating problems throughout 1969. During December 1969, the refinery was declared "fully operational" and throughput of about 80 percent of capacity was attained. The new much-publicized H-oil unit, which came on stream in November, 1969, will make considerable change in the refinery output pattern; not until it has operated for several months will it be known whether the 1.5-percent-sulfur-content residual fuel oil can be produced or if the flexibility in producing medium to light products can be realized.[2]

In 1968, a joint venture agreement with the Spanish national company, Hispanica de Petróleos, S.A. (Hispanoil) and KNPC created the Kuwait-Spanish Petroleum Co. (KSPC), with exploration and exploitation rights covering a large part of Western Kuwait and the northern half of Bubiyan Island. Exploration was scheduled for the latter part of 1969, with Bubiyan Island expected to hold the best promise.

A year-long controversy over new labor law legislation for the oil industry was climaxed by the issuance in June of Law No. 28 of 1969. The new law amends Kuwait's basic 1964 legislation concerning labor in the private sector, and in particular amends and corrects Law No. 43 of 1968. The new legislation liberalizes vacation and sick leave benefits, housing gratuities, and retirement benefits. The latter favors Kuwaiti as against non-Kuwaiti laborers.

KUWAIT-SAUDI ARABIA NEUTRAL ZONE

On December 18, 1969, the Governments of the Kingdom of Saudi Arabia and the State of Kuwait signed an agreement formally dividing the Neutral Zone and demarcating a new international boundary between the two countries. The document is supplemental to an earlier agreement signed in 1967. The boundary dividing the Neutral Zone is a straight line running east-west approximately bisecting the Neutral Zone. The new boundary was established primarily for administrative purposes, the present petroleum concessions continuing in force. Saudi Arabia will continue to receive payment for onshore production, all of which is on the Kuwait side of the boundary. Kuwait will continue to receive payment for offshore production from Khafji oilfield, which is the northern extention of Saudi Arabia's Safanija field.

[2] Petroleum Intelligence Weekly. V. 8, No. 52, Dec. 29, 1969, p. 4.

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Petroleum is the only commercially exploited mineral resources in the Neutral Zone. The status of an investigation of the suitability of oolitic limestone deposits for the manufacture of cement is not known. Payments to the Kuwait Government in 1968 resulting from petroleum production amounted to an equivalent of about $40 million; those to the Saudi Arabia Government totaled about $50 million. The lower figure for Kuwait reflects the marketing difficulties of the American Independent Oil Co. (Aminoil), the onshore concessionaire for Kuwait.

PRODUCTION

Following the trend that began in 1965, onshore crude oil production continued to fall, and offshore production continued to rise. However, offshore production increases in 1969 exceeded the onshore decline which resulted in an overall 4-percent increase during the year. Offshore production by the Japanese-owned Arabian Oil Co. Ltd. (AOC) amounted to 322,436 barrels per day during 1969; production of the joint operation onshore by Aminoil and Getty Oil Co. totaled 124,500 barrels per day. Although Aminoil is entitled to half of the joint production, the company's offtake was only 28 percent of total production. Aminoil's offtake has been declining the past several years, especially since the Suez Canal has been closed, the result of having few market outlets east of Suez. Moreover, Aminoil crude oil has an especially high sulfur content that is difficult to market in the industrialized countries.

Table 4.—Kuwait-Saudi Arabia Neutral Zone: Production of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1967	1968	1969
Crude petroleum	151,461	156,720	163,149
Petroleum refinery products: [1]			
Distillate fuel oil	3,242	159	140
Residual fuel oil	5,932	[2] 11,258	11,245
Other [3]	1,421	3,294	2,647
Total	10,595	14,711	14,032
Refinery fuel and loss	277	422	463

[1] Excludes output from Aminoil refinery in Kuwait.
[2] Includes some heavy distillate fuel oil.
[3] Mostly naphtha.

TRADE

Essentially all of AOC's output is marketed in Japan, and consequently it is not affected by the Suez Canal closure. Furthermore, the Japanese Government compels refiners in Japan to take certain amounts of AOC production. However, because of the high sulfur content of crude from Khafji oilfield and the tightening of anti-pollution regulations in Japan, Japanese refineries are pressing for the eventual elimination of the preferential market. Any possible decline in export demand for Khafji crude is expected to be offset by an increase in production from the new Hout oilfield that came into production during mid-1969.

Table 5.—Kuwait-Saudia Arabia Neutral Zone: Exports of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1967	1968	1969 •
Crude petroleum [1]	138,137	131,252	142,000
Petroleum refinery products: [2]			
Distillate fuel oil	3,141	150	NA
Residual fuel oil	3,249	5,408	NA
Other [3]	1,421	2,789	NA
Total	7,811	8,347	8,500

• Estimate. NA Not available.
[1] Includes some petroleum refinery products mixed with the crude oil before exporting.
[2] Excludes some petroleum refinery products mixed with the crude oil before exporting.
[3] Mostly naphtha.

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COMMODITY REVIEW

Mineral Fuels and Related Materials.—*Petroleum.*—Oil from Hout field will be blended with that from the Ratawi Zone of Khafji field to give an export blend having a sulfur content of 1.4 percent. Crude from the latter zone is of much higher quality than that from the Bahrain Zone of Khafji field, until now the major source of AOC crude. Average daily production of Hout field in the last 3 months of 1969 was 52,380 barrels. Facilities which are capable of handling 100,000 barrels per day of Hout production include flowlines; a 24-inch, 25-mile line carrying Hout crude to Khafji field; a 24-inch, 19-mile line carrying a blend of Hout and Khafji crude to onshore and offshore gas-oil separation systems; and four 268,000-barrel storage tanks. At yearend 1969, AOC was considering the construction of a 10,000- to 15,000-barrel-per-day desulfurization unit at their Khafji refinery.

SAUDI ARABIA

Although Saudi Arabia's petroleum industry made substantial advances in 1969 and continues to sustain the nation's economy, evidences of industrial diversification, particularly in the mineral areas, are becoming more apparent. A new 5-year development plan covering 1970–71 to 1975–76 was approved in September 1969. The plan envisages raising the gross national product (GNP) 9.3 percent annually during the plan period, compared with a 8.5-percent average annual increase in recent years. The plan also reaffirms the nation's policy of diversifying the sources of national income, and thereby reducing the country's heavy dependence on oil. In 1968–69, income originating from the oil sector accounted for about 50 percent of the GNP, 90 percent of foreign exchange earnings, and 85 percent of budget revenues. One objective of the plan is to reduce the oil sector contribution to GNP to 47 percent.[3] Tax and royalty payments in 1969 to the Government by the Arabian American Oil Co. (Aramco), the sole petroleum producer in Saudi Arabia proper, were $895 million. Payments by producers in the Neutral Zone are believed to have totaled $50 million that year. The Aramco payments represented a 2.6 percent increase over the 1968 figure of $872 million. The Government's income per barrel of crude produced by Aramco averaged $0.820 in 1969 compared with $0.842 in 1968. This decline resulted from the closure of the Trans-Arabian Pipeline (Tapline) during much of the year.

Until 1963, when the U.S. Geological Survey (USGS) was invited to make a systematic study of Saudi Arabia, the search for minerals was sporatic. Since then, USGS has been joined by the French Bureau de Recherches Géologiques et Minières (BRGM) and the Geological Survey of Japan. The Directorate General of Mineral Resources, an agency of Saudi Arabia's Ministry of Petroleum and Mineral Resources, has the responsibility of coordinating and administrating the nation's mineral resource development program.

Recent mapping has shown that the western part of the country consists of igneous and metamorphic rocks collectively termed the Arabian Shield where gold, silver, and copper were mined over a thousand years ago. Attention has been focused on the ancient mine workings, of which several hundred have been located. Some two dozen have been investigated by geological and geophysical surveys and by core drilling. Although no outstanding discoveries have been made yet, substantial mineralization has been encountered, and several prospects have reached the stage where shaft-sinking for bulk sampling is being considered.

PRODUCTION

Although no data are published on the production of nonmetals, cement production, based on partial year data is believed to have made a substantial gain; gypsum and lime production declined somewhat. Crude oil production rose an important 5.5 percent, however, this was the lowest rate of increase in recent years. The lower rate was occasioned by the closure of tapline for 110 days following sabotage on May 30, 1969.

[3] Middle East Economic Survey, Beirut, Sept. 26, 1969.

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Table 6.—Saudi Arabia: Production of mineral commodities

Commodity		1967	1968	1969
NONMETALS				
Cement	metric tons	323,239	[1] 510,800	• 550,000
Gypsum	do	27,752	40,302	• 35,000
Lime	do	6,500	10,870	• 9,000
MINERAL FUELS AND RELATED MATERIALS				
Crude petroleum	thousand 42-gallon barrels	948,110	1,035,778	1,092,322
Natural gas (marketed) •	million cubic feet	• 45,000	• 50,000	93,826
Petroleum refinery products:				
Aviation gasoline	thousand 42-gallon barrels	125	145	176
Motor gasoline	do	20,404	24,446	25,408
Jet fuel	do	9,438	13,177	13,962
Kerosine	do	2,885	3,081	3,190
Distillate fuel oil	do	16,221	18,738	18,265
Residual fuel oil	do	64,655	76,376	80,665
Liquefied petroleum gas	do	6,683	10,635	13,251
Other	do	842	822	891
Total	do	121,253	147,420	155,808
Refinery fuel and loss	do	5,577	5,755	5,635

• Estimate.
[1] For the period March 30, 1968 to March 18, 1969.

TRADE

Crude oil and petroleum refinery products which are essentially the only mineral commodities exported by Saudi Arabia were valued at about $1.6 billion in 1969. Major mineral imports are semimanufactured steel products, gold, and cement. The total value of mineral imports in the Hejira calendar year 1385 (May 1, 1965 through April 20, 1966) were equivalent to $50 million.

COMMODITY REVIEW

Metals.—*Copper.*—A profitable mine is now foreseen as a strong possibility at Jabal Sayid, where a copper, zinc, silver, and gold deposit was discovered by BRGM in 1965. The decision to go ahead with construction of a plant with a capacity of 1,000 tons of ore per day is dependent on the availability of enough water and the discovery of additional reserves. Known reserves are estimated from the surface to 350 meters at 8 million metric tons. These reserves have an average grade of 2.2 percent copper, around 1.4 percent zinc, and additional values of gold and silver. Exploration is continuing, both of the main ore body at a greater depth and at known prospects in the vicinity.

Iron and Steel.—A project for exploiting the Wadi Fatimah iron ore deposit has reached the final planning stage. Feasibility studies indicate that the iron ore from the deposits would be cheaper than imported ores. This ore would be fed to the Jidda steel plant which is still in the planning stage. Steel output from the plant would be about 200,000 tons per year. To achieve this target, an estimated 400,000 to 500,000 tons per year of ore will have to

Table 7.—Saudi Arabia: Exports of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1968	1969
Crude petroleum	891,675	938,547
Petroleum refinery products: [1]		
Motor gasoline	21,179	21,522
Jet fuel	13,298	14,100
Kerosine	1,430	1,366
Distillate fuel oil	15,322	13,541
Residual fuel oil	44,500	47,464
Other	9,905	13,139
Total	105,634	111,132

[1] Statistics are for Aramco only. Data on country of destination are not available. The continental distribution of total crude petroleum and petroleum refinery products exported in 1969 was as follows, in percent: Europe 49.1 percent; Asia 36.1 percent; South America 3.8 percent; North America 2.9 percent; Africa 4.9 percent; Australia 3.2 percent.

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Table 8.—Saudi Arabia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1965 [1]	1966 [2]
METALS		
Gold [3] thousand troy ounces	353	1,215
Iron and steel:		
Scrap	-------	2,593
Semimanufactures:		
Plates	1,893	998
Bars and rods	67,475	70,613
Sheets and angles	19,108	15,979
Tubes, pipes, and fittings	19,042	34,446
Other	1,972	2,244
NONMETALS		
Cement	339,680	491,770
Gypsum	-------	5,796
Marble	-------	5,795
MINERAL FUELS AND RELATED MATERIALS		
Lubricants	17,293	17,426
Paraffin and vaseline	2,125	2,682

[1] The Hejira Calendar year (1384) ending May 1, 1965.
[2] The Hejira Calendar year (1385) ending April 20, 1966, latest data available.
[3] Including platinum plated gold.

be mined. The iron ore deposits of Wadi Fatimah are about 45 kilometers east of Jidda and generally occur in two beds. Thickness of the major bed varies from 3.5 to 6.8 meters. Exploration through 1968 has found more than 22 million tons of ore to 25 meters deep with an average iron content of 47 percent.

The other iron ore deposits receiving the most attention in recent years have been those of the Wadi Sawadin district. Most of the ore is a fine-grained jaspilite, but some is a magnetite-hematite-quartz ore. The iron ore content of spot samples, which may represent the high grade parts of ore bodies, is 57 to 65 percent; that of samples which may represent the average composition of ore is 35 to 50 percent. The probable tonnage of iron ore above wadi level is estimated at 351 million tons, most of which has an average iron content of 40 to 50 percent. Concentration tests show that magnetic separation can upgrade the ore to about 60 percent iron with 92 to 94 percent recovery.

Nonmetals.—*Fertilizer Materials.*—The Saudi Arabian Fertilizer Co. (owned 51 percent by General Petroleum and Mineral Organization (Petromin) and 49 percent by Saudi Arabian private investors) completed its $50 million fertilizer complex at Dammam. Gas deliveries from Abqaiq oilfield began in August 1969. The plant, with a capacity of 600 short tons per day of ammonia and 1,100 short tons per day of urea, was expected to export about 300,000 short tons of urea during the remainder of 1969. Occidental Petroleum Corp. through its subsidiary International Ore and Fertilizer Corp., which provides technical and supervisory services, has guaranteed to market all production in excess of local demands for 20 years in return for 10 percent of net profits plus a selling commission amounting to 5 percent of gross sales.

In addition, Petromin has signed a final agreement with Occidental for the construction of a $20 million sulfur plant at Abqaiq. The completed plant will have a capacity to produce about 550 short tons per day of sulfur extracted from about 500 million cubic feet per day of gas from Abqaiq oilfield.

Results of drilling in the Turaif-Thaniyat area of northwest Saudi Arabia, which is under exploration by the USGS for the Saudi Arabian Government, reveal that the lower of two phosphate beds at West Thaniyat averages 1.65 meters in thickness and 23 percent P_2O_5. Reserves are approximately 200 million metric tons of ore containing 30 million metric tons of P_2O_5. Beneficiation will be a problem because of the argillaceous aspect of the ore.

Technicians have been considering the possibility of combining exploitation of these phosphate reserves with the pyrite reserves at Wadi Wassat for the manufacture of fertilizers, elemental sulfur, and iron ore pellets. These large pyrite deposits are estimated to be at least 125 million tons with more than 80 percent iron sulfides present, and currently are under active exploration and laboratory examintion.

Mineral Fuels and Related Materials.—*Petroleum and Natural Gas.*—Aramco, the only crude oil producing company in

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Saudi Arabia, produced 1,092 million barrels (2,993,000 barrels daily) in 1969, 5.5 percent more than in 1968. The increase was achieved despite the closing of the Tapline for 110 days following the sabotage on May 30, 1969. The rise was made possible by increasing exports from the Persian Gulf port of Ras Tanura by 13 percent.

Proved petroleum reserves as published by Aramco were 86 billion barrels at yearend 1969, a gross increase of 2.7 billion over 1968. A consulting engineering firm under contract to the Saudi Arabian Government has set resources at more than 140 billion barrels. At either level, there is little doubt that Saudi Arabia contains the largest crude oil reserves in the world. Natural gas reserves of 44 trillion cubic feet ranks the country with the world's top ten. Forty-six wells of all kinds were drilled in 1969. Seven wells were abandoned or suspended. During most of the year Aramco had three seismic crews in operation.

Aramco's first offshore gas-oil separator plant went on stream at Safaniya field, 25 miles from shore in the Persian Gulf. Initial capacity of the unit is 200,000 barrels per day. With the completion of 135 miles of pipelines, Aramco's total pipeline system, excluding collection lines totaled 2,014 miles at yearend 1969. Other facilities completed during 1969 were two gas-oil separators in the Shedgum area of the Ghawar field; additional stabilizing capacity at Abqaiq; and a second 630,000-barrel crude oil tank at Ras Tanura terminal. Three more tanks of like capacity are under construction at Ras Tanura, two for crude oil and one for residual fuel oil.

During 1969, Aramco announced plans for exploiting its half of the offshore Marjan/Fereidoon field which straddles the Iranian-Saudi Arabian boundary in the Persian Gulf. Plans include an offshore terminal to handle production from Marjan and the newly discovered Zuluf field.

Ghawar field continued as the country's largest, accounting for 1,489,000 barrels per day or 50 percent of the Aramco total in 1969. Other important fields were Abqaiq, 21 percent; Safaniya, 14 percent; and Khursaniyah 3 percent. During the year, 49 percent of the company's petroleum exports went to Europe while 36 percent went to Asia.

Saudi Arabia's state organization, continued efforts to diversity its petroleum operations. The major project scheduled is a new refinery at Riyadh. The 15,000-barrel-per-day, $22 million plant will be owned by Petromin and private Saudi investors. A pipeline is planned to supply the plant with crude from Aramco's Khurais field 80 miles northeast of Riyadh. Other projects include expansion of the Jidda refinery from 12,000 to 35,000 barrels per day; construction of a Jidda lubricating oil blending plant; and the laying of a natural gas pipeline from an unnamed field to Riyadh. Recently, Petromin announced the formation of Arabian Marine Petroleum Construction Co., a partnership venture in which Petromin owns 51 percent and J. Ray McDermott and Co., Inc., (a U.S. firm), 49 percent. It will undertake offshore rig construction. In addition, Petromin is interested in joint production ventures with Aramco, is participating in joint exploration ventures in Saudi Arabia with other companies, owns interests in geophysical and drilling companies, is interested in purchasing tankers for Persian Gulf-Red Sea shipments, and continues to survey international petroleum markets for possible sales of royalty crude oil.

A three-way agreement was signed in 1969 involving Saudi Arabian royalty oil, Rumanian refinery equipment, and Pakistani carpeting. Rumania, which is to supply and build the 37,000-barrel-per-day refinery in Pakistan, will be paid one-fourth in Pakistani carpeting and three-fourths in crude oil shipments from Saudi Arabia. Pakistan will have 14 years to repay the Saudis about $9 million.

In 1969, Tenneco Oil Co. and Société Auxilaire de la Régie Autonome du Pétroles (Auxirap), a member ot the Elf-ERAP group of companies, announced a gas-condensate discovery on a large geological structure 10 miles offshore in the northern Red Sea concession area. Reportedlv. each of the two wells completed in 1969 flowed at a rate of 12 million cubic feet of gas and 650 barrels of condensate daily through a one-half inch choke. At yearend 1969, development plans were pending.

The Sinclair Arabian Oil Co., owned 85.5 percent by Sinclair Oil Co. (a subsidiary of Atlantic Richfield Co.), 10 percent by the Oil and Gas Development Corp. (a Pakistan state agency), and 4.5 percent by Natomas Co. (a U.S. firm) conducted

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three party-months of seismic surveying in 1968. The company was to decide in 1969 which of the optioned parcels it would take as a concession.

Exploration in the 86,459-square-kilometer concession held jointly by the Phillips Petroleum Co. (a U.S. firm) and a subsidiary of the Italian State Petroleum agency, Ente Nazionale Idrocarburi (ENI) was stepped-up in 1969. Most of the work was performed in the Rub 'al Khali parcel where a wildcat well is scheduled to be drilled in 1970.

The results of work performed by Continental Oil Co., which had a short-term agreement with the Government to do seismic work in an offshore Red Sea reserve area before defining an exploration concession, have not been announced.

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The Mineral Industry of Liberia

By Walter C. Woodmansee [1]

Production and export of iron ore, concentrate, and pellets continued to dominate the Liberian mineral industry during 1969. Liberia retained it position as Africa's leading producer and the world's third largest exporter of iron ore. Expansion was underway at most ore mining operations. Estimated value of iron ore shipments in 1969 was $128 million,[2] about 49 percent of a gross national product (GNP) estimated at $262 million (current prices) by the Department of National Planning and Economic Affairs. Other mineral industry contributors to the GNP were diamond, $40.8 million; petroleum refinery products, estimated at $7.8 million; cement, $1.5 million; and gold, $39,000. Estimated value of mineral industry output was $178 million.

Field surveys and exploration for new iron ore deposits continued at several locations. Liberian American-Swedish Mining Co. (LAMCO) made plans to develop extensions to its Nimba deposit in bordering Guinea. Bong Mining Co. conducted exploration in the Putu mountains of southeastern Liberia, and Liberia Mining Co. (LMC) actively worked in the Bie mountains of southwestern Liberia. Liberian Iron and Steel Corp. (LISCO) made further progress in its large-scale project involving an international consortium in the Wologisi mountains of northern Liberia.

Surveys also were conducted for other mineral commodities. Dresser Industries, Inc. made progress in its barite concession. A concession was not granted to significant kyanite prospects, but negotiations were underway with two American companies. The Bureau of Natural Resources and Surveys conducted geological investigations of clay deposits in the Bushrod Island-New Georgia area, silica sand in the Monrovia area, and lime (shell) deposits on Cape Palmas. A mineral survey project in central and western Liberia was approved by the Governing Council of the United Nations in January.

In the petroleum sector, several offshore concessions were granted, and seismic surveys were started. Liberia's first petroleum refinery went on stream in January.

PRODUCTION AND TRADE

Output of iron ore, as reported by the individual mining companies, continued to expand and totaled nearly 17 percent more than in 1968. Another increase was expected in 1970. The decline in gold production was attributed to a shift of miners to more profitable diamond mines, where a new discovery was made. Undetermined quantities of gold were sold directly by miners to local jewelers rather than to the Bank of Monrovia. In the nonmetals sector, cement output, which was determined by domestic demand, was limited to about 60 percent of capacity. Diamond production was based on data from the Bureau of Natural Resources and Surveys. The new petroleum refinery satisfactorily completed its first year of operation.

According to data provided by the Department of Planning and Economic Affairs, exports of mineral commodities (including only those listed in table 2) comprised a major portion of total exports in 1968, the latest year for which complete data were available. Mineral commodity exports were valued at $128.8 million, constituting 76 percent of exports and reexports of all commodities valued at $169 million. Value of iron ore and concentrate exports alone was $118 million. Other sig-

[1] Physical scientist, Bureau of Mines, Washington, D.C.

[2] Liberia uses U.S. dollar currency.

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nificant mineral commodity exports were industrial diamond ($9.1 million) and gold ($1.5 million). Iron ore exports were as follows, by type (thousand tons): Lump ore, 13,439; fines, 4,734; and pellets, 1,025.

Mineral commodity imports were valued at $15.8 million, including $6.9 million for petroleum refinery products and $3.7 million for iron and steel, mainly semimanufactures. Total imports of all commodities were $109 million. Venezuela (436,000 barrels) and Saudi Arabia (218,000 barrels) were the principal sources of crude petroleum for the new refinery. Refinery products were imported principally from the United States ($3.3 million), United Kingdom ($1.4 million), and Curaçao ($1.1 million). The United States, Japan, West Germany, and Belgium were the main sources of iron and steel.

Table 1.—Liberia: Production of mineral commodities

Commodity [1]		1967	1968	1969
METALS				
Gold [2]	troy ounces	5,111	3,216	1,136
Iron ore	thousand metric tons	18,224	19,571	22,866
NONMETALS				
Cement [e]	do.	------	r 50	70
Diamond: [3]				
Gem	thousand carats	362	537	562
Industrial	do.	181	213	184
Total	do.	543	750	746
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline, motor	thousand 42-gallon barrels	------	------	396
Kerosine and jet fuel	do.	------	------	151
Distillate fuel oil	do.	------	------	602
Residual fuel oil	do.	------	------	612
Other	do.	------	------	10
Total	do.	------	------	1,771

[e] Estimate. [r] Revised.
[1] In addition to commodities listed, construction materials such as common clay, sand and gravel were produced, but quantitative data are not available.
[2] Purchases by Bank of Monrovia.
[3] Exports for fiscal year ending August 31.

Table 2.—Liberia: Foreign trade in selected mineral commodities in 1968
(Metric tons unless otherwise specified)

EXPORTS AND REEXPORTS		
METALS		
Gold, unrefined	troy ounces	44,516
Iron and steel:		
Ore and concentrate	thousand metric tons	18,918
Metal:		
Scrap		630
Semimanufactures		21
Nickel, metal, all forms		10
Nonferrous metals, scrap		289
NONMETALS		
Diamond, industrial	carats	792,985
Salt		4
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products, mainly distillate fuel oil	42-gallon barrels	23,291
IMPORTS		
METALS		
Aluminum:		
Oxide and hydroxide		3
Metals, including alloys, semimanufactures		120
Copper, metal, including alloys, semimanufactures		34
Gold, unworked and partly worked	troy ounces	2,241
Iron and steel, metal:		
Scrap		161
Pig iron and ferroalloys		207
Ingots and other primary forms		210
Semimanufactures		11,364
Lead, metal, including alloys, all forms		33
Platinum-group metals, including alloys, all forms	troy ounces	2
Silver, metal, including alloys, all forms	do.	118
Zinc, metal, including alloys, all forms		34
Metallic oxides, n.e.s.		99
Alkali rare-earth metals		31
Nonferrous metals, n.e.s.		6

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Table 2.—Liberia: Foreign trade in selected mineral commodities in 1968—Continued

IMPORTS—Continued		
NONMETALS		
Abrasive materials, natural:		
Pumice, emery, etc.		228
Grinding and polishing wheels and stones		57
Cement		86,211
Clays and clay products:		
Minerals, refractory		31,266
Products, refractory		226
Diamond, industrial	value	$899
Diatomite		6
Fertilizer materials:		
Natural:		
Nitrogenous		243
Phosphatic		5
Potassic, salts		365
Manufactured:		
Nitrogenous		12,280
Phosphatic, basic slag		696
Potassic		152
Mixed		1,240
Ammonia		943
Gypsum and plaster		166
Lime		1,505
Salt		3,372
Sodium and potassium compounds:		
Caustic soda		820
Caustic potash		11
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked, mainly calcareous		495
Worked		65
Gravel and crushed rock		5,458
Limestone, except dimension		5,721
Sand		625
Sulfur:		
Elemental		1
Sulfuric acid		197
Minerals, crude, n.e.s.		49
Building materials of asphalt, asbestos and fiber, cement and unfired materials		925
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural		16
Carbon black and gas carbon		21
Gas, hydrocarbon, manufactured	value	$124,418
Petroleum:		
Crude and partly refined	thousand 42-gallon barrels	661
Refinery products:		
Gasoline	do.	412
Kerosine and jet fuel	do.	99
Distillate fuel oil	do.	647
Residual fuel oil	do.	347
Lubricants	do.	42
Asphalt and bitumen	do.	19
Total	do.	1,566
Mineral tar and other crude chemicals derived from the distillation of coal, petroleum, or gas		203

Table 3.—Liberia: Iron ore exports

(Thousand metric tons)

Destination	1968	1969
Belgium-Luxembourg	1,238	1,275
Canada	366	--
France	883	1,202
Germany, West	6,115	6,589
Greece	48	416
Italy	2,645	2,413
Japan	1,139	2,081
Netherlands	1,878	1,807
United Kingdom	1,846	1,489
United States	2,608	3,341
Other	152	105
Total	18,918	20,718

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COMMODITY REVIEW

METALS

Iron Ore and Concentrate.—Each of the four operating mining companies in Liberia—Bong Mining Co., LAMCO, LMC, and National Iron Ore Co. Ltd. (NIOC)—reported substantial increases in ore production and shipments during 1969. Output by company and type of product was as follows, in thousand metric tons:

Bong Mining Co.: Concentrates	4,463
Liberian American-Swedish Mining Co. (LAMCO):	
Run-of-mine ore	537
Lump ore	4,183
Fines	4,549
Pellets	1,526
Subtotal	10,795
Liberia Mining Co. (LMC):	
Lump ore	996
Fines	928
Concentrates	908
Subtotal	2,832
National Iron Ore Co. Ltd. (NIOC):	
Lump ore	1,545
Fines	3,231
Subtotal	4,776
Total	22,866

Expansion was underway at most operations, and output was expected to reach 24 million tons in 1970. LAMCO, the leading producer, was building a second crusher station at a cost of $5.7 million and a number of ancillary facilities at its Nimba mine. The company confirmed the existence of a new ore body, containing 150 million tons of concentrating ore, at Mount Tokadeh, near the present railhead.[3] According to the local press, LAMCO will develop the nearby extension of the Nimba deposit in bordering Guinea and ship the ore via its railroad to Buchanan port, providing an agreement is concluded with the Governments of Liberia and Guinea.

The second expansion program of Bong Mining Co., underway at its mine in the Bong mountains, includes a crude ore blending system, new beneficiation equipment, and a new $45-million, 2-million-ton-per-year pelletizing plant.[4] A new ball mill and the seventh and eighth concentrating lines (completed during the year) will increase annual concentrate capacity to 5 million tons. Engineering for the new pellet plant is by Wedag Bochum, West Germany. Allis-Chalmers Manufacturing Co., United States, will provide plant designs and specifications. The plant will employ the Allis-Chalmers grate-kiln process. Construction is by Rheinstahl Export and Industrie Unlagen GmbH, Essen, West Germany. Completion was expected late in 1970.[5]

Active field work continued throughout the year at the deposit controlled by LISCO in the Wologisi mountains, 230 kilometers northeast of Monrovia. LISCO, which holds a concession from the Liberian Government, plans development by an international consortium. Mackay and Schnellmann Ltd., London, consultants who performed the original geological and exploratory studies, were preparing a final report on their investigations. Tests reportedly indicate a substantial ore deposit, on the order of 2 billion tons. Motor-Columbus A.G., engineering consultants, Baden, Switzerland, were preparing a comprehensive feasibility study, scheduled for completion late in 1971. F. Krupp GmbH, West Germany, are engineering contractors, and Raymond International, Inc., New York, are construction engineers.[6]

NONMETALS

Barite.—Dresser Industries, Inc., Houston, Tex., which was granted a 50-year concession to the Gibi deposit, conducted exploration during the dry season and prepared a program for the next field season.

Diamond.—A new deposit was discovered in the Kakata area, 55 kilometers from Monrovia. Details on size and importance were not available. Increasing quantities of diamond were reportedly entering Liberia illegally from neighboring countries.

[3] Engineering and Mining Journal. V. 170, No. 7, July 1969, p. 147.
[4] Skillings Mining Review. V. 58, No. 38, Sept. 20, 1969, pp. 4–9.
[5] American Metal Market. V. 76, No. 81, May 1, 1969, p. 19.
[6] Metal Bulletin. No. 5404, June 6, 1969, p. 33.

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Table 4.—Liberia: Diamond shipments, by company, during fiscal 1968 [1]
(Carats)

Buyer	Quantity			Value (thousands)
	Gem	Industrial	Total	
Diamond Import-Export Co.	167,845	95,816	263,661	$12,500
Hatton Diamond Co.	64,973	33,213	98,186	2,700
Kimla Diamond Co.	5,150	697	5,847	300
Liberia Diamimpex Co.	40,183	12,601	52,784	2,500
Liberia European Trading Co.	58,079	12,133	70,212	2,400
Nybelgo Diamond Co.	79,487	22,766	102,253	10,800
Sodiamex Diamond Co.	118,492	35,161	153,653	7,600
Other	2,703	867	3,570	100
Total	536,912	213,254	750,166	38,900

[1] Fiscal year ending Aug. 31, 1968.

MINERAL FUELS

Petroleum.—*Exploration.*—Early in the year, Syracuse Oils Ltd., Calgary, Alberta, Canada, announced acquisition of a 25-percent interest in 8,000-square-kilometer coastal Block 4B. Other participants are Sunningdale Oil Co. Ltd., also a Canadian firm, 25-percent interest, and Pan Ocean Oil Co., 50-percent interest. Syracuse Oils will be the operator.[7]

In February, the Liberian Government issued invitations to bid on offshore Block A and Block B, comprising 3,000 square kilometers from Monrovia northerly to the Sierra Leone border and 3,500 square kilometers in the Buchanan area, respectively. The deadline for bids was extended from March 31 to May 31 at the request of a number of interested companies. Block A was awarded to Union Carbide Petroleum Co., a subsidiary of Union Carbide Corp. Block B was awardel to Frontier Petroleum Co. Both companies planned seismic surveys during 1969–70.[8]

In October, Block C, between Blocks A and B, was open for bidding. Chevron Overseas Petroleum Co., a subsidiary of Standard Oil Co. of California, signed an agreement for this concession. Blocks A, B, and C comprise about two-thirds of the offshore area.

Terms of these agreements were believed to include a 50-percent income tax, based on posted or reference prices, cash bonuses on signature and on production of 100,000 and 200,000 barrels per day, 12½-percent expensed royalty, 50–50 profit split, rentals, periodic 25-percent relinquishment of acreage, a 6-year exploration program, and a 25-year development program.[9]

Liberia's only refinery, operated by Liberia Refining Co., completed its first year of operation. The $15 million, 10,000-barrel-per-day facility of Sunray DX Liberia Oil Co. and Hydrocarbon Research, Inc. (HRI) is located at Gardnersville, 9 kilometers from the port of Monrovia. Crude throughput was 2,034,000 barrels. Sunray DX Liberia Oil Co. manages the operating company as well as International Fuel Corp., Liberia's first barge-operated, ship-refueling service, also owned jointly with HRI. The refinery has facilities for regular and premium gasoline, kerosine, jet fuel, diesel fuel, residual fuel oil, liquefied petroleum gas, and asphalt.[10]

[7] Petroleum Press Service. V. 36, No. 7, July 1969, p. 273.
[8] Petroleum Intelligence Weekly. V. 8, No. 32, Aug. 11, 1969, p. 8.
[9] Oil and Gas Journal. V. 67, No. 13, Mar. 31, 1969, p. 44.
[10] Oil and Gas Journal. V. 67, No. 1, Jan. 6, 1969, p. 49

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The Mineral Industry of Libya

By Walter C. Woodmansee [1]

Expansion of crude oil production and exports continued in 1969 but not to the extent anticipated at the beginning of the year. The September 1 coup, in which a group of military officers assumed control of the Government, had little effect on production and shipment of oil. The Revolutionary Command Council and its newly appointed Prime Minister affirmed continued cooperation with the operating oil companies but stressed that the Government will institute more effective control over oil industry activities. The operating companies completed expansion programs in progress at the time but tended to withhold further expansion plans.

Annual crude oil production exceeded 1 billion barrels, and oil revenues to the Government exceeded $1 billion,[2] both for the first time. The 1968 oil revenues were $952 million, based on an average rate of $1.007 per barrel.[3]

A number of petroleum-related operations were planned or under development. Esso's natural gas liquefaction plant, the world's largest to date, was essentially completed at the Marsa el-Brega oil and gas terminal. A sulfur recovery plant, part of the natural gas plant, was also under construction at this terminal. Occidental of Libya, Inc. planned ammonia, naphtha, and lubricating-oil plants in conjunction with National Libyan Petroleum Corp. (Lipetco). Establishment of a petrochemical industry and a second petroleum refinery, owned by the Government, were also under consideration.

Throughout the year, the Ministry of Petroleum furthered its plans to tighten supervision of oil operations, control production, protect the country's oil resources, and increase oil revenues. Starting in January, all operating oil companies were required to accelerate tax and royalty payments, according to a plan approved in 1968. According to Ministry of Petroleum officials, these additional payments will exceed $1 billion during the next 5 years. In January the Ministry presented concession holders a preliminary draft of new Petroleum Regulation 8, dealing with conservation, and Regulation 9, which was designed to replace Regulations 1–7. Regulations 1–7 had been appended to the Petroleum Law of 1955. Libya was the first country to adopt the newly recommended Oil Producing and Exporting Countries oil conservation laws, including provisions for compulsory unitization of any field underlying properties of more than one operator and Government control of flared or unused wellhead gas. The main controversial and negotiable subjects in Regulation 9 are crude oil posted prices, which in the past have been fixed by the producing companies, taxes, certain operating procedures and expenses, and relinquishment provisions.

The previous Government planned a September meeting on proposed Regulation 9 with oil company representatives, but negotiations were disrupted by the coup on September 1. At yearend the new Government and the operating companies were preparing for a confrontation early in 1970.

A number of new concession agreements were under negotiation or concluded in 1969. Lipetco made joint-venture agreements with Ashland Oil and Refining Co., AGIP Inc., and Shell Oil Co. In August Japanese oil firms negotiated with Lipetco for concessions on a joint-venture basis. According to Lipetco officials, the new arrangements will include a Government share of up to 50 percent in any eventual production, a 15 to 16 percent fully expensed royalty, stricter work obligations on

[1] Physical scientist, Bureau of Mines, Washington, D.C.

[2] Where necessary, values have been converted from Libyan pounds (£L) to U.S. dollars at the rate of £L1=US$2.80.

[3] Petroleum Intelligence Weekly. V. 8, No. 42, Oct. 20, 1969, p. 6.

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the part of the participating companies, larger employment of Libyan nationals, large cash bonuses to the Government, and additional features such as assistance in establishment of petrochemical plants, refineries, gas and refinery products pipelines, and marketing facilities.

In March, the Second Development Plan for 1969–74 was approved by Parliament, promulgated by royal decree, and became effective on April 1. It calls for an expenditure of $3.2 billion during the 5-year period, compared with $1.3 billion under the first plan. The plan stresses ambitious industrialization and agricultural development for greater diversity and less dependence on petroleum. Private participation is encouraged, but the Ministry of Industry has not been successful in attracting private capital. In the minerals sector, $5.2 million has been appropriated for exploration and research, including work on clays, iron, lime, marble, and phosphate. A new geological map of Libya is under preparation in connection with the investigations of mineral resources.

Occidental continued development of the huge ground-water resources discovered in the Kufra Basin, southeast Libya, in March 1968. Twelve irrigation wells have been drilled, and large-scale agricultural projects have been started. Enormous reserves of nonsaline, multipurpose water, sufficient for any foreseeable irrigation projects, occur in continental Nubian sands from near surface to depths of 2,750 feet.[4]

PRODUCTION

Crude oil output averaged 3.1 million barrels per day, compared with 2.6 million barrels per day in 1968. The 3-million-barrel-per-day plateau was reached for the month of May. At midyear, a record 50 drill rigs were working, including 15 for Occidental and 10 for Mobil/Gelsenberg, and 869 wells were in production. Further production increases were expected during 1970.

In February, Esso Standard Libya Inc. produced its billionth barrel from the Zelten field since production began in August 1961. However, in May, Esso was replaced by the Oasis Oil Co. of Libya, Inc. group as the leading producer in Libya. Occidental's output increased 59 percent over 1968 production, and in September the company shipped its 300 millionth barrel since initial production in February 1968. American Overseas Petroleum Ltd. (Amoseas) output jumped 51 percent in 1969. At yearend the total output rate was 3.3 to 3.4 million barrels per day.

[4] U.S. Embassy, Tripoli. State Department Dispatch A-197, Aug. 4, 1969, 10 pp.

Table 1.—Libya: Production of mineral commodities

Commodity		1967	1968	1969
NONMETALS [1]				
Cement [2]	thousand metric tons	------	------	• 50
Gypsum	metric tons	• 10,000	14,400	• 15,000
Salt	thousand metric tons	• 16	• 16	• 16
MINERAL FUELS AND RELATED MATERIALS				
Natural gas, gross production [3]	million cubic feet	• 415,000	620,000	666,525
Petroleum:				
Crude	thousand 42-gallon barrels	636,504	948,519	1,134,839
Refinery products:				
Motor gasoline	do.	• 370	494	
Naphtha	do.	• 90	122	
Kerosine	do.	• 160	215	NA
Distillate fuel oil	do.	• 500	666	
Residual fuel oil	do.	• 750	972	
Total	do.	• 1,870	2,469	NA

• Estimate. NA Not available.

[1] Libya also produces construction materials such as sand, gravel, crushed stone, brick, and tile, but output data are not available.

[2] Cement production apparently started in 1969, rather than in 1967 as previously reported.

[3] Mostly flared.

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Table 2.—Libya: Crude oil production, by company

(Thousand 42-gallon barrels per day)

Company	1968	1969
Oasis Oil Co. of Libya, Inc.	686.0	789.7
Esso Standard Libya, Inc.	740.6	746.2
Occidental of Libya, Inc.	381.6	608.1
American Overseas Petroleum, Ltd. (Amoseas)	243.5	368.9
British Petroleum Co., Ltd.-Nelson Bunker Hunt	304.1	321.3
Mobil Oil Libya, Ltd./Gelsenberg Benzin, A.G.	235.5	264.5
Société Nationale des Pétroles d'Aquitaine	------	5.5
Phillips Petroleum Co. of Libya	7.4	6.0
Pan American Libyan Oil Co.	1.1	.5
Total	2,599.8	3,110.7

TRADE

During 1968, the latest year for which complete data are available, the value of crude oil exports was $1,868 million of total exports valued at $1,871 million. According to a survey published by the Organization for European Cooperation and Development, Libya was Western Europe's largest crude oil supplier, providing 24 percent of total oil imports. U.S. imports of Libyan crude oil nearly tripled in 1968 and averaged 146,000 barrels per day.

Imports of supplies and equipment by oil companies and related service companies for petroleum operations constituted the largest single import category, valued at $157 million. Imports from the United States totaled $93 million, largely in oil company purchases.

Table 3.—Libya: Exports and reexports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
EXPORTS		
Metals:		
Iron and steel:		
Ore	-----	138
Scrap	4,069	3,865
Nonferrous metals:		
Ore and concentrate	----	98
Scrap	608	567
Nonmetals:		
Gypsum and plaster	-----	25
Sulfur	-----	111
Mineral fuels and related materials:		
Petroleum, crude thousand 42-gallon barrels	627,188	945,144
REEXPORTS		
Metals:		
Iron and steel:		
Scrap	98	-----
Semimanufactures	8	1,988
Nonmetals:		
Cement	10	5
Mineral fuels and related materials:		
Petroleum, refinery products:		
Gasoline thousand 42-gallon barrels	1,365	305
Kerosine ---do---	-----	138
Distillate fuel oil ---do---	-----	760
Residual fuel oil ---do---	-----	67
Total ---do---	1,365	1,270

Table 4.—Libya: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, including alloys, all forms	2,213	1,799
Copper, including alloys, all forms	944	1,172
Iron and steel:		
Ore and concentrate	-------	2
Metal:		
Scrap	94	5
Pig iron, ferroalloys, and similar materials	-------	14
Steel, primary forms	4,917	481
Semimanufactures	211,130	310,714
Lead, including alloys, all forms	407	499
Platinum and platinum group, unworked or partly worked troy ounces	-------	5,755
Silver:		
Ore and concentrate	64	-------
Metal, unworked or partly worked troy ounces	514	106,778
Tin, including alloys, all forms long tons	67	19
Zinc, including alloys, all forms	468	484
Nonferrous, scrap	-------	5
NONMETALS		
Abrasive materials:		
Natural	7,923	11,000
Grinding and polishing wheels and stones	105	173
Asbestos, crude	-------	59
Cement thousand tons	701	721
Chalk	-------	13
Clays and clay products:		
Crude clays thousand tons	14	55
Products:		
Refractory	-------	251
Nonrefractory	86,527	153,800

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Table 4.—Libya: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968
NONMETALS—Continued		
Fertilizer materials:		
Crude	430	201
Manufactured, mainly nitrogenous	21,550	26,553
Graphite	-------	204
Gypsum and plaster	316	742
Lime	51,379	78,320
Mica, worked	14	85
Pigments, mineral	510	916
Salt	252	46
Stone, sand and gravel:		
Dimension stone, crude and worked	14,728	21,488
Gravel and crushed rock	14,004	35,518
Sand	-------	211
Sulfur	1	25
Talc and steatite	40	60
Nonmetals, n.e.s	319	2,080
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	30,078	48,464
Coal, coke, and briquets	2,250	3,606
Gas, hydrocarbon:		
Natural	-------	7,809
Manufactured	-------	518
Petroleum, refinery products:		
Gasoline thousand 42-gallon barrels	1,482	1,592
Kerosine and jet fuel do	230	195
Distillate fuel oil do	1,750	1,952
Residual fuel oil do	279	332
Lubricants do	96	122
Other do	255	625
Total do	4,092	4,818
Mineral tar and other crude chemicals derived from coal, oil, and gas	-------	767

Table 5.—Libya: Crude oil exports, by country of destination

(Thousand 42-gallon barrels)

Destination	1967	1968
Belgium	33,284	30,326
Brazil	-------	1,542
Canada	5,896	-------
Denmark	13,162	8,878
France	80,615	75,327
Germany, West	148,570	260,184
Greece	1,414	-------
Italy	129,234	183,238
Netherlands	58,127	68,415
Netherlands Antilles	2,803	1,261
Norway	6,689	10,447
Rumania	-------	1,180
Spain	27,891	56,848
Sweden	1,899	482
Switzerland	6,281	8,056
Trinidad and Tobago	7,197	6,323
Turkey	3,726	4,024
United Kingdom	75,737	171,956
United States	18,268	53,230
Yugoslavia	4,324	1,968
Other	2,021	1,469
Total	627,138	945,144

COMMODITY REVIEW

NONMETALS

Cement.—Libya's first cement plant, that of National Cement Co., near Homs, 120 kilometers east of Tripoli, was inaugurated in July after 4 years of construction. Initial capacity is 350 tons per day. The $10.5 million project included a power station. The Ministry of Industry provided 88 percent of the capital. A 600-ton-per-day plant, under construction at Benghazi for Libyan Cement Co., is expected on stream in 1971, also largely financed by the Ministry of Industry. Total annual capacity of the two plants is about 340,000 tons. Annual consumption was expected to reach 800,000 to 1 million tons within a few years; studies were therefore underway for the establishment of other plants.

Clays.—A new brick plant under construction near Zansur for National Industrial Metal Co. was scheduled for completion in May 1970. Annual capacity is 100,000 tons, the quanity of brick imported in 1968 at a cost of $2.8 million. Clay raw materials will be extracted from pits at Garian and Jeffran.

Fertilizer Materials.—In January Occidental of Libya Inc. announced plans for a $30 million ammonia plant in conjunction with the Government on a 50–50 basis. Natural gas feedstock (estimated 50 million cubic feet per day) and the plant site were undetermined. Initial rated capacity is 220,000 tons per year.

Libya and Tunisia agreed to cooperative fertilizer production. The former will provide natural gas and the latter will provide phosphate from its extensive phosphate rock resources.[5]

Lime.—The Ministry of Industry considered construction of small lime plants in connection with the cement plants at Homs and Benghazi. Raw materials and facilities

[5] Nitrogen. No. 57, January-February 1969, p. 9.

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common to the two operations would be used.

Sulfur.—A 45,000-ton sulfur recovery unit was under construction at the Marsa el-Brega terminal of Esso Standard Libya Inc. Sulfur will be recovered from natural gas, prior to gas liquefaction, and cast in blocks for export. The plant was designed and engineered by Ralph M. Parsons Co. Ltd.[6]

Other Nonmetals.—The Ministry of Industry concluded agreements with Libyan companies in the following projects: With Ben Barka Co. for development of silica at Abu Ghelan and establishment of a glass factory in Tripoli; with Mezughi Feki Co. for development of marble quarries near Tarhuna and Beni Walid; with Azzabi Co. for gypsum mines in the Bir Ghenim, Jeffren, and Garian areas; and with United Mining Co. for limestone and bentonite exploration in the Homs area.[7]

MINERAL FUELS

Natural Gas.—Liquefied natural gas (LNG) shipments from the Esso Standard Libya plant at the Marsa el-Brega terminal were originally scheduled for January, but technical problems and two pipeline explosions and fires delayed startup. Trial shipments were scheduled to Spain and Italy late in the year. The plant was expected to be fully operational early in 1970. It will provide natural gas in Spain for the first time and add one-third to Italy's estimated supply in 1970. The small methane tanker *Aristotle* (capacity 32,000 barrels) was chartered by Esso for trial shipments to Barcelona, Spain, and La Spezia, Italy, pending delivery of four specially constructed, 250,000-barrel, methane tankers. (Three are under construction in Italy; one is being built in Spain.) Esso has a 15-year contract to supply 110 million cubic feet per day to Gas Natural S.A., a subsidiary of Catalana de Gas, Spain, and a 20-year contract for 235 million cubic feet per day to Italy's SNAM Progretti S.p.A. In addition to the $85 million liquefaction plant, the project included gas compression plants at the Raguba and Zelten fields and new harbor facilities at Marsa el-Brega. The basic plant design was prepared by Esso Research and Engineering Co., New Jersey; the refrigeration cycle was developed by Air Products and Chemicals Corp., Pennsylvania, which also built the four 197-foot, cryogenic exchangers for cooling the gas to −259° F; general engineering and procurement of equipment was by Bechtel Corp., California; and construction was by SNAM Progretti S.p.A. and Compagnia Italiana Industriali, S.p.A.[8]

In January, Occidental of Libya Inc. announced plans for a $60 million, 68,000-barrel-per-day natural gas liquids and liquefied petroleum gas (LPG) plant at the Zuetina terminal. The natural gasoline and LPG would be recovered from associated gas, which is produced at a rate of 650 million cubic feet per day at the Idris fields. Remaining dry gas will be reinjected into the producing reservoirs. The liquids will be transported by a new, 215-kilometer, 20-inch pipeline, parallel to the existing main crude-oil line, to condensate recovery and LPG fractionation facilities at Zuetina.

Petroleum.—Amoseas, operator for Texas Oil Co. and Standard Oil Co. of California, was producing at a rate of 380,000 barrels per day at midyear, mostly from its large Nafoora field. Shallow Tertiary development was completed, and deeper drilling (9,000 to 10,000 feet) in Cretaceous and Precambrian formations continued with three rigs. The newly expanded Amal-Ras Lanuf pipeline and tanker-terminal system, shared with Mobil/Gelsenberg, reached capacity of 650,000 barrels per day.

British Petroleum-Nelson Bunker Hunt's expansion of the pipeline from the Sarir field to the Marsa el-Hariga terminal, near Tobruk, was completed. The project, which increased export capacity to 412,000 barrels per day, included expansion of the water injection scheme and desalting capacity; additional flow lines and gas-oil separators; a condensate recovery unit; enlargement of the pumping station and a new booster station on the main line; and a second tanker berth and additional tank storage at the terminal.[9]

Following its oil discovery in concession 66 in western Libya, Gulf Oil considered construction of a 378-kilometer pipeline to a proposed terminal near Tripoli. A number of small discoveries in the region would probably be tied in.[10]

[6] Sulfur. No. 85, November-December 1969, p. 9.
[7] U.S. Embassy, Tripoli. State Department Dispatch A-198, Aug. 4, 1969, p. 3.
[8] Pipe Line Industry. V. 31, No. 5, November 1969, pp. 40-43.
[9] World Petroleum. V. 40, No. 4, April 1969, pp. 22-23.
[10] Petroleum Press Service. V. 36, No. 8, August 1969, p. 312.

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Mobil Oil Libya Ltd., operator for its joint venture with Gelsenberg Benzil A.G., continued development of the large Amal field and the nearby U-12 field, discovered in 1968. Two new fields were discovered in concession 12; a well, 24 kilometers southwest of the Amal field, flowed high-gravity, low-sulfur crude at 750 barrels per day, and the second strike, 56 kilometers south of Amal, tested 953 barrels per day, also of high-gravity, low-sulfur crude oil.[11]

Oasis Oil Company of Libya, comprised of Continental Oil Company, Marathon Oil Company, and Amerada-Shell interests, became Libya's leading producer when combined output reached 812,000 barrels per day in May. A 100,000-barrel increase resulted from completion of the 270-kilometer, 24-inch line from the Waha and Zaggat fields directly to the Es Sider terminal, bypassing the detour to the Dahra field in the western part of the Sirte Basin.[12] New capacity was 860,000 barrels per day which could be raised further with additional pumping capacity. The new Bahi field in concession 32 on the west flank of the Sirte Basin, 32 kilometers northwest of the Dahra field, was expected to add 50,000 to 75,000 barrels per day during 1970. A new 48-kilometer, 20-inch spur is under construction to the main Dahra-Es Sider line. Oasis also has the "P" structure, south of the Gialo field, where eight of nine wells were successful. Exploratory and development drilling continued.[13]

Early in the year, Occidental of Libya, Inc., completed installation of five 42-inch and 48-inch undersea pipelines from the Zuetina terminal to mooring buoys more than 5 kilometers offshore. At Zuetina a 72-inch line carries crude oil from the trunkline to a 560,000-barrel storage tank and from this tank to the sea lines. Arabian Bechtel Corp. was contractor for new production, pipeline, and storage facilities at the Idris D and Augila fields.[14] Completion of this expansion raised Zuetina terminal loading capacity to 1 million barrels per day and storage capacity to 7 million barrels.

In June, Sirtica Shell Ltd. became the fifth operating company to sign a joint-venture agreement with Lipetco. The concession area comprises 26,000 square kilometers in five onshore and offshore blocks (numbers 130, 165, 138, and 139 A and B). The exploration period is 10 years, extendable for 2 years; the exploitation period is 25 years after the first oil shipment. Shell agreed to minimum work requirements of $11 million during the first 3 years and $20 million during the next 7 years. Lipetco may assume a 25-percent interest in production up to 500,000 barrels per day and a 50-percent interest if output should exceed this rate. Shell agreed to pay production bonuses, graduated up to $15 million, and all exploration costs for 10 years. Development expenditures would be reimbursed in proportion to Lipetco's eventual participation.[15] Shell also agreed to assist Lipetco's entry into oil refining by arranging financing and construction of a 25,000-barrel-per-day refinery near Tripoli, and a 600-barrel-per-day lubricating oil blending plant. Shell will provide refinery management services for 10 years. Lipetco also will acquire 25 service stations—15 from Shell's marketing chain and 10 new stations built by Shell at sites selected by Lipetco.

Ashland Oil and Refining Co. was granted additional concession areas totaling 1.85 million acres in the Sirte Basin under a joint-venture agreement with Lipetco. According to terms of the agreement, Lipetco may take a 30-percent interest if an oil discovery is made and production reaches 200,000 barrels per day and up to a 50-percent interest if production reaches 400,000 barrels per day. AGIP, Inc., a member of the Italian Ente Nazionale Idrocarburi group, continued development work on its 1968 discovery, 60 kilometers northeast of the Gialo field, in concession 100. Bosco Middle East Petroleum Co., with concessions 134 and 135, planned further drilling after two dry holes in concession 135. Circle Oil Co., three-fourths owned by Ashland, conducted seismic work and a second test well in block 121. Libyan Clark Oil Co. began a new drilling program in partnership with Amoseas in concessions 119 and 120. The MURCO group, comprising Spanish (Hispanoil), French (SNPA and Auxerap), and American (Murphy Oil Co.) interests, became Libya's eighth oil-

[11] Oil and Gas Journal. V. 67, No. 8, Feb. 24, 1969, p. 56.
[12] World Oil. V. 168, No. 6, May 1969, pp. 76–79.
[13] Oil and Gas Journal. V. 67, No. 27, July 7, 1969, pp. 82–83.
[14] Pipe Line Industry. V. 30, No. 5, May 1969, p. 81.
[15] Oil and Gas Journal. V. 67, No. 24, June 16, 1969, p. 44.

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exporting company when the group commenced oil exports in August. This also was the initial production for companies representing French and Spanish interests. The output rate was 20,000 barrels per day from six producing wells at the Magid field in concession 105. MURCO built a 100-kilometer, 14-inch feeder line to the Mobil/Amoseas' Nafoora field. Elwerath Oil Co. Libya-Wintershall Libya, Inc., was granted a permit to five onshore and offshore blocks in eastern Libya. Stepout drilling continued in concession 97, 24 kilometers southeast of the Gialo field.

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The Mineral Industry of Malaysia

By A. F. Grube [1] and Ta Li [2]

Malaysia's 1969 mineral output was valued at $303.7 million, about 9 percent higher than that of 1968. Tin production alone, for many years an economic mainstay for the Malay peninsula, was valued at about $252 million in 1969. Aside from national income derived from tin sales, the Government receives significant revenues from duties imposed on tin exports; such duties amounted to approximately $40 million in 1969. Although the May civil disturbances closed the Penang tin market for 3 days, they had no appreciable effect on tin production, since the disturbances were confined to the Kuala Lumpur area; all affected operations in the area returned to normal by the end of May.

Although Malaysian tin reserves were adequate to maintain the present level of production, efforts to explore and exploit tin potential in Government reservations and offshore areas in West Malaysia were continued by the Malay Government. Malaysian tin mining is currently typified by Chinese gravel pump mines and European dredges.

Japan's Overseas Mineral Resources Development Company, Ltd. announced in May 1969 that it would invest $70 million to develop a copper deposit near Mamut, Sabah. The project is presently in the advanced stages of exploration, and commercial operation may begin by 1972. Construction on the integrated steelworks at Prai, West Malaysia proceeded on schedule during the year, adding a second blast furnace and another oxygen furnace.

The Malaysian Government concluded three petroleum agreements in 1969 with three separate American oil companies—Southeast Asia Gulf Company, Mobil Oil (Malaya) Sdn. Bhd., and Amoco Malaysia Petroleum Company. These agreements cover the entire Continental Shelf adjacent to West Malaysia's west coast, and, along with previously granted petroleum concessions, cover the entire offshore areas of West Malaysia.

In September of 1969, the Minister of Commerce and Industry announced that Government policy on joint ventures within Malaysia would be reviewed. Present policy requires 51 percent local equity participation for pioneer companies and 50 percent for nonpioneer companies. The minister said that he was prepared to permit a greater flexibility in the ratio of share capital distribution if the companies concerned were export-oriented and did not wholly require the support of the domestic market.

Under the 1968 Investment Incentive Act, the following were added to the list of pioneer industries in October 1969: The manufacture of portland cement; the rolling, casting, and extruding of nonferrous metals; and the manufacture of various chemicals, including pesticides.

An agreement dealing with the boundaries of the Continental Shelf between Malaysia and Indonesia was signed in 1969 by the Governments of these countries. At yearend, it was indicated that the two countries would soon commence talks to demarcate the territorial waters in the Straits of Malacca.

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PRODUCTION

Higher world tin prices were the principal cause for the rise in the value of Malaysian mine production. Although production of tin-in-concentrates decreased, its value increased from $231 million in 1968 to $252 million in 1969. Iron ore production in 1969 was valued at $37 million, slightly higher than that of the previous year. Bauxite production valued at $4.3 million in 1968 increased to $5.7 million in 1969. The only bauxite mines in operation during the year were the two in West Malaysia, since the mines in Sarawak have been closed for the past 4 years.

The increased production of crude oil, over twice that of 1968, was made possible by the continuing development of the recently discovered offshore oilfield in West Lutong, Sarawak. Value of crude oil production in 1969 was $6.4 million compared with $2.9 million in 1968.

For the past 4 years, virtually all of Malaysia's mineral output, other than crude oil and gold, has come from West Malaysia. Sarawak has produced all of the crude oil and 65 percent of the gold in the country. Sabah's only mineral production consists of relatively small amounts of construction materials, such as stone, gravel, cement, and clay bricks.

Table 1.—Malaysia: Production of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Aluminum, bauxite, gross weight—thousand tons	900	799	1,073
Antimony, mine output, metal content (Sarawak)	31	23	39
Columbium and tantalum, ores and concentrates (columbium-tantalum ratio, 4:7; 70 to 80 percent pentoxides)	88	52	64
Copper, mine output, metal content • (exports)	254	319	250
Gold, mine output, metal content:			
West Malaysia—troy ounces	1,290	1,454	3,153
Sarawak—do	2,521	2,718	2,271
Iron and steel:			
Iron ore and concentrate—thousand tons	5,436	5,167	5,233
Pig iron and blast furnace ferroalloys •	20,000	60,000	60,000
Ingot steel •	20,000	60,000	60,000
Manganese, ore and concentrate, gross weight (30 to 40 percent manganese)	85,105	45,121	NA
Rare earth metals:			
Monazite (exports)	962	2,138	2,054
Xenotime (yttrium mineral exports)	260	70	153
Tin:			
Mine output, metal content—long tons	72,121	75,069	72,167
Metal, including secondary—do	76,328	88,318	88,482
Titanium, ilmenite concentrate, gross weight (exports)	90,806	125,825	132,625
Tungsten, mine output, metal content	15	65	138
Zirconium, concentrates (zircon), gross weight (exports)	472	1,126	1,417
NONMETALS			
Cement •—thousand tons	835	900	900
Kaolin—do	2	2	2
Lime (Sarawak)	160	21	NA
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude oil (Sarawak)—thousand 42-gallon barrels	328	1,521	3,286
Refinery products:			
Gasoline—do	7,106	9,628	10,009
Kerosine and jet fuel—do	1,855	7,431	7,869
Distillate fuel oil—do	3,272	15,521	15,722
Residual fuel oil—do	• 20,000	15,619	16,245
Other—do	4,585	1,672	2,328
Refinery, fuel and loss—do	2,483	2,271	2,712
Total—do	39,301	52,142	54,885

• Estimate. p Preliminary. NA Not available.

[1] All minerals are produced in West Malaysia unless otherwise indicated.

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TRADE

Malaysian smelter-tin exports amounted to 90,000 long tons in 1969, 3,900 long tons more than in 1968. Tin export prices during the year averaged $1.53 a pound and the value reached $313.2 million, 11 and 13 percent higher, respectively, than 1968 levels. The major buyers of Malaysian tin were the United States (38,201 long tons), Japan (24,684), Italy (5,450), and the Netherlands (4,528). Shipments to the United States decreased in 1969, but purchases by Japan and Eastern Europe increased appreciably. West Malaysia exported 5,200,895 tons of iron ore in 1969, most of it going to Japan, as compared with 5,106,707 tons in 1968. The only other important mineral commodity export was crude oil and petroleum products from Sarawak. Data for the first 7 months of 1969 showed such exports running slightly ahead of the $94 million exported in 1968. The value includes reexport of crude oil received from Brunei.

West Malaysia's 1968 major mineral commodity imports were as follows: Crude oil and petroleum products valued at $64.4 million; tin ores valued at $48.4 million; and iron and steel products valued at $39.8 million. Sarawak's only significant import was crude oil and petroleum products valued at $92.2 million. Sabah's major import consisted of petroleum products valued at $6.8 million.

Table 2.—West Malaysia: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
EXPORTS			
METALS			
Aluminum, bauxite		875,978	789,412
Copper, ore and concentrate		1,016	1,276
Iron and steel:			
Iron ore	thousand tons	5,330	5,107
Iron and steel scrap		87,391	26,115
Manganese ore and concentrates		60,281	40,744
Thorium ore		1,222	2,207
Tin:			
Ore and concentrates	long tons	1,176	1,002
Slag and hardhead	do.	24,897	3,495
Metal and alloys, all forms	do.	73,573	85,983
Titanium, ores and concentrates (ilmenite)		90,806	125,819
Zircon		472	1,127
NONMETALS			
Cement and clinker		265,958	236,317
Fertilizer materials: Manufactured, all types		3,620	15,508
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude oil (reexport)	thousand 42-gallon barrels	2,371	3,744
Refinery products:			
Gasoline	do.	695	1,305
Kerosine and jet fuel	do.	604	865
Distillate fuel oil	do.	830	667
Residual fuel oil	do.	1,599	1,209
Other	do.	86	80
Total	do.	3,814	4,126
IMPORTS			
METALS			
Aluminum, metal and alloys, all forms		4,529	4,407
Copper, metal and alloys, all forms		2,199	2,706
Iron and steel:			
Primary forms		12,111	19,156
Semimanufactures:			
Bars, rods, and shapes		146,849	69,678
Plates and sheets		129,713	130,805
Other		90,713	84,629
Tin, ore	long tons	6,769	23,504

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Table 2.—West Malaysia: Foreign trade in selected commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
IMPORTS—Continued			
NONMETALS			
Asbestos		11,097	10,353
Fertilizer materials:			
Crude, phosphate rock		101,911	86,307
Manufactured:			
Nitrogenous		122,615	57,770
Phosphatic		6,111	3,926
Potassic		56,323	54,091
Salt		84,613	86,127
Sulfur		3,182	5,845
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades, including briquets		11,126	12,272
Coke		6,950	5,813
Petroleum:			
Crude	thousand 42-gallon barrels	17,729	21,027
Refinery products:			
Gasoline and naphthas	do	853	843
Kerosine and jet fuel	do	733	624
Distillate fuel oil	do	2,978	3,234
Residual fuel oil	do	133	296
Lubricants	do	182	173
Other	do	139	262
Total	do	5,018	5,432

Table 3.—Sarawak: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967
EXPORTS AND REEXPORTS		
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude oil	thousand 42-gallon barrels	15,858
Unfinished oils	do	1,565
Refinery products:		
Aviation gasoline	do	89
Motor gasoline	do	741
Kerosine	do	1,639
Jet fuel	do	3,998
Distillate fuel oil	do	1,050
Residual fuel oil	do	8,625
Total	do	16,142
IMPORTS		
METALS		
Iron and steel, metal, all forms		20,394
Tin, metal, all forms	long tons	109
NONMETALS		
Asbestos, all forms		3,357
Cement and clinker		23,832
Fertilizers:		
Crude, phosphatic		5,727
Manufactured		16,134
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude oil	thousand 42-gallon barrels	36,696
Unfinished oils	do	397
Refinery products:		
Aviation gasoline	do	5
Motor gasoline	do	147
Kerosine	do	30
Jet fuel	do	112
Distillate fuel oil	do	234
Residual fuel oil	do	17
Lubricating oil	do	30
Other	do	15
Total	do	590

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Table 4.—Sabah: Imports of petroleum refinery products
(Thousand 42-gallon barrels)

Commodity	1967
Gasoline	170
Kerosine	80
Jet fuel	116
Distillate fuel oil	311
Residual fuel oil	35
Other	56
Total	718

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—Late in 1969 the Federal Industrial Authority of Malaysia approached Alcan Malaysia Berhad, a subsidiary of Alcan Aluminum Ltd., concerning the possibility of establishing an alumina plant or smelter in Malaysia. A similar project was considered several years ago but was dropped as not being viable at the time. All Malaysian bauxite production continued to come from Alcan's deposit located near Johore, West Malaysia.

Copper.—The Overseas Mineral Resources Development Co., Ltd., (OMRDC) a joint Japanese-Malaysian mining company, has completed 2 years of copper prospecting at Mamut, Sabah. Based upon the favorable results of the investigation, full-scale development of the deposit will begin in the very near future. A new company, provisionally called the Mamut Mine Development Co., was formed by eight Japanese firms—including Mitsubishi Metal Mining Co. Ltd., Nippon Mining Co. Ltd., and Sumitomo Metal Mining Co. Ltd.—to develop the deposit. The company will operate jointly with another company already set up by OMRDC and the Malaysian Government. The Sabah State Government has awarded the company mining rights to the deposit. Copper reserves at the deposit are estimated at between 90 and 120 million tons of ore grading at about 0.6 to 0.8 percent copper. The company plans the construction of a concentrator with an annual capacity of 40,000 tons of copper metal. Production is expected to start in 1972 with the copper concentrate to be shipped to Japan.

Iron Ore.—The bulk of Malaysia's iron ore output is derived from two large iron mines owned by the Eastern Mining and Metals Company Ltd.—one at Dungan in Trengganu and the other at Rompin in Pahang. The Dungan mine has ore reserve and declining grade problems, although the mine is expected to continue producing ore at an annual rate of about 1.5 million tons for several years. On the other hand, the Rompin mine has considerable reserves and is under contract to deliver 1.8 million tons per year of iron ore to Japanese steel mills. The quality of the Rompin fine ore is also comparatively high, so that the ore is much favored by the Japanese.

Iron and Steel.—The second phase of the Malayawata Steel Berhad expansion program is expected to be completed by the end of 1970 with the third phase commencing within the next 2 years. The second phase has consisted of the addition of another blast furnace, a bigger oxygen plant, and extensions to the rolling mills. The third phase, according to current plans, will include an electrolytic tinning line. The complex equipment is expected to be fully operational by the end of 1972.

The Australian firm Bradford Kendall Ltd. received Malaysian Government approval to establish a steel foundry works near Kuala Lumpur, West Malaysia. The venture will be owned, 50 percent each, by Malaysian interests and the Australian company. At yearend 1969, another Australian firm, Broken Hill Pty. Co., Ltd., announced that it was joining with Malaysia and Singapore interests in establishing a plant to produce low-carbon wire and galvanized wire rope. The plant is expected to be in operation before the end of 1971.

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Mercury.—A three-man Japanese inspection team arrived in Malaysia towards yearend 1969 to investigate the possibilities of mining mercury in the State of Sarawak. No results of the investigation have been reported.

Tin.—The Malaysian tin industry, the world's largest, had another good year in 1969. Production of tin-in-concentrates totaling 72,167 long tons marked the second highest level since post-1941. A world tin shortage existed in 1969 as prices in the London Metal Exchange rose from a January low of $3,240 per long ton to a December high of $3,840 per long ton. As a result, the tin export quotas established by the International Tin Council (ITC) were increased each quarter of 1969 and finally abolished in December. At yearend 1969, 1,067 mines were in operation, of which 65 operations employed dredges and 955 employed gravel pumps. About 58 percent of Malaysian tin is extracted by gravel pumping and 31 percent by dredging.

During late 1969, the Government called for an all-out effort to increase tin production in Perak, Malaysia's largest tin producing State. A number of proposals were made to achieve this goal, including the formation of two special committees, one to quickly process new tin mining applications and the other to investigate the possibility of opening additional areas in the Upper Perak District for tin mining.

Despite recent Government policies to encourage Malaysians to take an active part in tin mining, the bulk of the country's tin is still mined by Chinese and European firms. The Malaysian Government, in 1967, established a special fund with an initial allocation of $160,000 to grant loans to Malaysians opening new mines in Malay Reservations. Although only one loan of $16,000 has been granted since the fund's establishment there are extensive tin prospects. Government teams have prospected over 270,000 acres in 67 areas designated as Malay reservations. More than 20 areas totaling 30,000 acres have been located as containing "worthwhile" tin deposits.

The jurisdictional dispute between the State and Federal Governments concerning offshore tin mining was resolved at yearend 1969. The dispute concerned the Federal Government's insistence on being consulted with regard to the granting of offshore prospecting licenses. The following three foreign companies were given tin exploration rights to offshore areas bordering the western coast of West Malaysia: Ocean Mining Company, Conzinc Riotinto Malaysia Ltd., and N.V. Billiton Maatschappij.

Oriental Tin Smelters Ltd., a Japanese owned firm, suspended its smelter operations at Kuala Lumpur in late 1969 because sufficient quantities of tin concentrates were difficult to obtain. However, Japanese interests were actively engaged in the mining sector of the Malaysian tin industry. A new, joint Malaysian-Japanese tin-mining firm, Pacific Industrial and Mining Co. was established in late 1969. The company plans to start tin mining operations in Perak. Initially capitalized at $1 million, the Japanese will retain a 25-percent interest in the concern. The Japanese will also supply $2.4 million worth of dredging equipment. Malaysia Gold and Tin Dredging, another Malay-Japanese venture, will begin prospecting operations early next year on four river beds in Perak, Trengganu, and Pahtung.

A meeting of major tin consuming and producing countries will be held in Geneva in early 1970 to work out the details of a Fourth International Tin Agreement. Certain significant changes were envisioned by Malaysian delegates. One change deals with the financing of buffer stocks used for price supports. Under the previous three tin agreements, maintenance costs of buffer stocks were the responsibility of producer countries, who were generally less developed countries and therefore likely to experience difficulties in financing the stocks. Consumer countries will now be asked to bear some of the financing. Another change concerns the upward resetting of floor and ceiling prices under which the buffer stocks are increased and decreased. Producer countries believe that such a change is justified, because in recent years tin mining costs have increased substantially.

Malaysian tin reserves may be significantly increased through the use of trackless equipment in tin mining. In the past, all tin mining operations ceased when the limestone rock was reached, although high-grade pockets of tin ore still existed within the limestone. When conventional

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track-laying equipment was employed to mine the limestone, operating costs became extremely high due to the abrasive nature of the water-borne limestone. Through the use of trackless equipment, repair costs and downtime have been reduced to a minimum, and such equipment also has been proven to handle materials much faster.

Much of the considerable research by both private industry and the Malaysian Government was discussed at the Second International Technical Conference on tin held under the auspices of the ITC in Bangkok, Thailand, in late November. Studies were aimed at increasing mining efficiency and at treating and refining tin ores.

NONMETALS

Cement.—All Malaysian cement production continued to be supplied by two companies with three plants in 1969. Associated Pan-Malaysia Cement Ltd., by far the larger, has two plants located in Ipoh and Rawang (in Selangor). Tasek Cement Ltd. owns the third plant, also at Ipoh. The two firms had a combined cement capacity in excess of 1.5 million tons annually, considerably larger than current output.

Fertilizer Materials.—The Asean Chemical Fertilizer Sdn. Bhd., a joint Malaysian-Chinese firm, announced in mid-1969 that it would build a $1.5-million agricultural-chemical plant. The plant is projected to commence operations in 1970 and will be located either in Cheras or Taiping, West Malaysia. Production from the plant has been planned to meet consumption requirements of both Malaysia and the surrounding area.

MINERAL FUELS

Petroleum.—During the year the Malaysian Government offered for lease four tracts of land totaling 19,000 square miles in the Malacca Straits. In July, the Minister of Lands and Mines and National and Rural Development announced that three United States companies had been granted licenses in principle for these tracts. Mobil Oil (Malaya) Sdn. Bhd. was awarded two of the tracts, and the Southeast Asia Gulf Company and Amoco Malaysia Petroleum Company were awarded one tract each. Terms and conditions for the leases are currently under discussion between the companies and the Government. The Government, however, has indicated it wants participation with the three companies.

In May 1969 a group of seven Sumitomo firms and the Teikoku Oil Company of Tokyo signed an agreement with the French Aquitaine Petroleum Company whereby the Japanese firms would participate in the development of the French company's 3,700 square kilometer concession off the coast of Sabah, Malaysia. The seven Sumitomo firms are as follow: Sumitomo Shoji Kaisha, Ltd.; Sumitomo Metal Industries, Ltd.; Sumitomo Chemical Co.,; Sumitomo Metal Mining Co. Ltd.; Sumitomo Coal Mining Co.; Sumitomo Electric Industries, Ltd.; Sumitomo Chemical Co.; and Fire Insurance Co. The Japanese firms established the Sabah Marine Areas Co., Ltd., to conduct operations in Sabah.

During the year no additional commercial oil discoveries were made, and the State of Sarawak remained Malaysia's only oil producing State. Sarawak Shell Berhad holds the concession from which this production is obtained.

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The Mineral Industry of Mexico[1]

By Burton E. Ashley [2]

The mining industry in Mexico was estimated to have increased its total value of mineral output (excluding petroleum) by 8.3 percent over the value attained in 1968. Substantial investment continued in exploration and expansion of metallurgical plants. A continued moderate growth was expected for the industry over the next few years, but present and planned expansion should be reflected in much higher production levels by about 1975.

Cía. Metalúrgica Peñoles, S.A., changed its corporate name to Industria Peñoles, S.A., and transferred its metallurgical activities to a wholly owned subsidiary, Met-Mex Peñoles, S.A.. The capital structure was also changed so that the Mexican-owned interest was increased to 75 percent. In addition to completing its magnesium oxide plant in Coahuila and continuing development of its lead-copper property in Querétaro, Peñoles announced its decision to build a $40 million electrolytic zinc refinery at Torreón.

Expansion in the steel industry continued, and per capita consumption of steel grew by 48 percent to 160 pounds, with a total apparent consumption of about 3.7 million tons. It was estimated that in order to satisfy demand over the next 10 years, capacity must be increased to around 9 million tons annually. To achieve this capacity, an investment rate of $135 million a year for the next 10 years will be necessary. Some foreign financing will be needed, and some steel manufacturers received total credits of more than $4 million during 1969 from the Export-Import Bank.

Additional incentive to the expanding industry was provided by the Government's approval for the first rise in steel prices in 12 years. The average increase amounted to about 8 percent in the following categories: Structurals—2.7 percent; rails—15 percent; plates—15 percent; and hot and cold rolled sheets—14.47 percent. The increases were approved on the condition that the increased revenue would be reinvested to increase capacity.

The Mexican industry supplied about 92 percent of domestic iron and steel requirements in 1969.

Officials of the State and Federal Governments conferred on the state of the local Sonoran mining industry at the First Seminar on Development of Mining Activity in Sonora. As Sonora is considered to be a promising area for mineral development, the Governor of Sonora pledged full support for all mining enterprises, not only to develop the industry but to alleviate the high unemployment rate there. Slow growth in the Sonoran industry was attributed, in part, to the lack of basic geological information.

Presidential candidate Lic. Luis Echeverría, in an address to the National Reunion of Mining Development Studies, promised to direct his attention to (1) strengthening of official institutions that assist the mining industry; (2) an exhaustive study of fiscal policies to stimulate mining activity; and (3) greater incentives for investment in the mining industry.

The new labor law, which will come into effect early in 1970, will be of interest to the mining industry. Under the law, housing, or an equivalent allowance, must be provided by all firms having more than 100 employees, including smelters and mines in populated areas. Any employer operating more than 3 kilometers from a town must also provide housing. It will also be a requirement that 90 percent of an employer's labor force be Mexican; all

[1] Much of the text for this chapter was supplied by Mr. W. F. Keyes, Minerals Officer, U.S. Embassy, Mexico, D.F.

[2] Physical scientist, Bureau of Mines, Washington, D.C.

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technical and professional employees must be Mexican unless Mexican specialists are not available. It was recognized that in the case of the mining industry, there was a great shortage of qualified technical and administrative personnel, so the employment of foreigners in such positions has continued.

It was estimated that the total labor force in the extractive industry numbered between 200,000 and 300,000 persons.

The Mexican Chamber of Mines donated U.S. $800,000 for the period 1969–70 to form a trust to provide incentive for the education of mining technical personnel. The trust is to provide scholarships, field trips, and other assistance to students in mining and related fields. The trust will be administered by the Secretary of National Patrimony, the presidents of the Chamber of Mines and of the Mexican Association of Mining Engineers, Geologists and Metallurgists, plus another representative of the Chamber of Mines.

PRODUCTION

The trend of output volume was mixed with ups and downs throughout the list. Mexico regained its world position as the leading silver producer with 42.9 million troy ounces. Other wide production swings were recoded in white arsenic (calculated), down by nearly one-half the preceding year's figure, and a rise in selenium output from 1 ton to 198 tons. Production of fluorite continued its upward trend.

Table 1.—Mexico: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Aluminum, metal, primary	21,512	22,518	32,383
Antimony:			
Mine output, metal content	3,738	3,464	3,149
Metal (in mixed bars)	986	1,090	848
Arsenic, white [1]	r 14,967	13,531	7,983
Bismuth, metal (in refined and mixed bars)	504	525	606
Cadmium:			
Mine output, metal content	1,246	1,194	1,579
Metal, refined	168	202	210
Copper:			
Mine output, metal content	56,012	61,110	66,167
Matte, metal content [2]	74	79	8,287
Precipitate, metal content [2]	246	80	76
Metal:			
Blister [2]	7,403	8,224	----------
Refined	47,054	51,483	56,670
Gold:			
Mine output, metal content, troy ounces	165,287	176,952	180,599
Metal, refined, do	NA	172,745	169,163
Iron and steel:			
Iron ore, metal content	1,617,096	1,921,299	2,096,970
Iron ore, 60 percent Fe equivalent [1]	2,695,160	3,202,165	3,494,950
Pig iron	1,279,298	1,598,910	1,695,254
Sponge iron	325,924	373,560	402,659
Ferroalloys	54,612	48,266	53,287
Steel ingots and castings	3,059,533	3,285,050	3,470,008
Steel semimanufactures	4,235,001	4,589,625	5,109,659
Lead:			
Mine output, metal content	163,907	174,169	170,894
Metal (in refined and mixed bars)	161,470	172,260	169,016
Manganese:			
Ore, metal content	30,799	26,706	27,061
Ore, 45 percent Mn equivalent [1]	68,442	59,347	60,136
Mercury, metal, primary, 76-pound flasks	14,417	17,202	22,500
Molybdenum, mine output, metal content, kilograms	r 64,000	79,880	201,519
Nickel, mine output, metal content	28	26	85
Selenium, mine output, metal content, kilograms	2,062	1,095	198,000
Silver, mine output, metal content, thousand troy ounces	38,273	40,031	42,904
Tin:			
Mine output, metal content, long tons	588	519	280
Metal, primary, do	607	317	139
Tungsten, mine output, metal content	188	266	289
Zinc:			
Mine output, metal content	241,215	240,021	253,375
Metal, primary	70,861	80,038	80,265

See footnotes at end of table.

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Table 1.—Mexico: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
NONMETALS				
Barite		223,280	246,539	176,921
Cement, hydraulic		5,597,208	6,125,788	6,787,184
Clays:				
Bentonite		32,580	40,073	46,017
Fuller's earth		18,643	11,281	21,401
Kaolin		78,592	75,715	89,732
Refractory		98,049	102,037	101,740
Diatomite		7,186	9,944	11,175
Feldspar		63,600	80,257	83,493
Fertilizer materials:				
Crude (natural), phosphate rock		54,264	25,913	32,574
Manufactured:				
Nitrogenous, gross weight		450,200	780,885	1,148,782
Phosphatic, gross weight [3]		231,600	209,478	388,563
Mixed, gross weight		251,399	270,927	271,281
Fluorspar, all grades		785,114	926,000	988,304
Graphite, all grades		40,690	52,964	42,920
Gypsum and anhydrite, crude		976,401	1,235,242	1,291,093
Mica, all grades		884	737	594
Perlite		10,572	9,929	10,130
Quartz, quartzite, and glass sand		253,732	297,203	281,881
Salt, all types	thousand tons	3,330	e 3,000	e 3,000
Stone, sand, and gravel, n.e.s.:				
Crushed and broken:				
Dolomite		349,890	377,161	475,029
Limestone e	thousand tons	r 9,000	10,000	10,000
Marble		18,005	3,658	1,268
Strontium minerals		2,543	3,453	18,077
Sulfur, elemental:				
Frasch process		r 1,821,860	1,607,597	1,631,367
Other native (mined)		23,920	24,306	26,845
Byproduct (from natural gas)		48,307	53,045	57,959
Sulfates, natural, sodium		68,757	NA	106,384
Talc and related materials, talc		2,918	641	1,333
Wollastonite		1,504	69	4,567
MINERAL FUELS AND RELATED MATERIALS				
Coal, bituminous	thousand tons	2,388	2,605	2,458
Coke:				
Coke	do	1,030	1,084	1,141
Coke breeze		r 58,014	87,082	NA
Gas: [4]				
Manufactured, all types	million cubic feet	6,531	6,852	NA
Natural:				
Production	do	572,832	576,871	609,056
Marketed	do	275,502	285,430	283,057
Petroleum:				
Crude [5]	thousand 42-gallon barrels	149,924	160,486	149,661
Refinery products:				
Gasoline:				
Aviation	do	639	520	551
Motor	do	40,984	43,910	46,078
Kerosine	do	12,076	11,812	11,575
Jet fuel	do	1,984	2,243	2,681
Distillate fuel oil	do	23,746	26,567	27,581
Residual fuel oil	do	43,428	43,057	43,135
Liquefied petroleum gas	do	9,152	11,079	12,002
Lubricants	do	1,394	1,370	1,371
Asphalt, refinery	do	6,289	6,844	7,976

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Calculated equivalent from mine production.

[2] For export.

[3] Includes 62,800 tons of triple superphosphate in 1967, 65,000 (estimated) tons in 1968, and 149,880 tons in 1969.

[4] Converted at 35.3145 cubic feet per cubic meter.

[5] Includes natural gas liquids.

Note: "Mine production," where listed, is the total metal content of all products, such as concentrate, matte, precipitate, and impure metal for export, plus content of products processed in Mexico.

TRADE

The tables of foreign trade show no significant change in trade pattern. The United States remained Mexico's chief trading partner in terms of value.

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Table 2.—Mexico: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Antimony:			
Ore and concentrate	9,555	8,160	All to United States.
Metal, including alloys, all forms	188	313	Mainly to United States.
Arsenic:			
Trioxide, pentoxide, and acids	8,252	3,034	All to United States.
Metal, including alloys, all forms	2,455	3,348	Do.
Bismuth, metal, including alloys, all forms	596	571	Mainly to United States.
Cadmium:			
Intermediate metallurgical products	724	716	Do.
Metal, all forms	189	174	Brazil 67; United States 62; Netherlands 28.
Copper:			
Ore and concentrate	2,088	1,200	All to United States.
Copper sulfate	965	454	United States 234; Brazil 220.
Metal, including alloys, all forms	7,711	10,756	Japan 4,262; United States 2,954; West Germany 1,705.
Gold—troy ounces	3,265	2,390	Mainly to United States.
Iron and steel:			
Ore and concentrate	78	138	Mainly to West Germany.
Metal:			
Scrap	139	499	All to United States.
Steel, primary forms, ingots	57	9,486	Mainly to Switzerland.
Semimanufactures	101,574	149,615	Mainly to United States.
Lead:			
Ore and concentrate	919	1,305	Do.
Oxides:			
Litharge	30,991	32,304	Do.
Red lead	2,938	4,429	United States 2,487; Denmark 531.
Metal, including alloys:			
Antimonial and other bars	12,100	13,168	Netherlands 7,822; United States 2,833.
Refined bars	83,860	82,005	United States 48,856; Italy 14,234; Brazil 8,389.
Manganese, ore and concentrate	10,449	6,958	Mainly to United States.
Mercury—76-pound flasks	12,698	14,124	Do.
Molybdenum, concentrate	11	154	All to United States.
Nickel, metal, including alloys	2	-------	
Silver, metal—thousand troy ounces	28,935	37,318	West Germany 11,750; United Kingdom 11,563; United States 8,490.
Tin, concentrate—long tons	2,649	-------	
Tungsten, concentrate	260	419	United States 275; United Kingdom 63.
Zinc:			
Ore and concentrate	r290,441	298,402	Mainly to United States.
Oxide, white	7,782	7,520	Do.
Sulfate	2,556	2,107	Do.
Metal, including alloys:			
Powder	295	451	Mainly to Argentina.
Unwrought, refined	33,086	42,165	United States 18,154; Brazil 17,495.
Unwrought, crude	219	4	All to Venezuela.
Other metals and metallic residues	631	325	Mainly to United States.
NONMETALS			
Abrasives, natural:			
Emery	2	57	Do.
Pumice	4	7	All to United States.
Asbestos	10,603	-------	
Barite and witherite	119	99	Mainly to United States.
Cement	1,563	38,898	Mainly to Brazil.
Clays and clay products: Crude clays, n.e.s.:			
Bentonite	1	115	Mainly to Guatemala.
Fuller's and other earths	164	2,169	Peru 1,099; Colombia 495.
Kaolin	24	4	Mainly to Venezuela.
Other clays, including refractory	108	105	Colombia 51; Peru 32.
Diatomite, infusorial earth, tripoli, and chalk	2,798	6,103	United States 2,776; Argentina 1,722.
Feldspar	151	5	Mainly to Costa Rica.
Fertilizer materials:			
Crude	34,418	28,794	Mainly to United States.
Manufactured:			
Nitrogenous	1,329	8,134	Mainly to Nicaragua.
Phosphatic	591	1,293	Mainly to Guatemala.
Potassic	357	372	All to Guatemala.
Other, including mixed	1,910	2,929	Mainly to Guatemala.
Fluorspar:			
Acid grade	248,930	254,801	Mainly to United States.
Metallurgical grade	507,349	677,959	United States 483,934; Canada 188,691.
Graphite, natural	38,722	50,619	Mainly to United States.

See footnote at end of table.

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Table 2.—Mexico: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
NONMETALS—CONTINUED			
Gypsum:			
Crude	873,945	1,161,218	United States 832,805; Canada 59,346.
Calcined	70	3	Guatemala 2.
Lime	32	95	All to United States.
Mica, all forms	234	10	Do.
Precious and semiprecious stone except diamond ...kilograms	367	179	Japan 127; United States 48.
Salt ...thousand tons	2,760	2,993	Japan 2,093; United States 645.
Stone, sand, and gravel:			
Dimension stone	7,440	5,954	Mainly to United States.
Crushed rock	291	158	Do.
Limestone and dolomite	395	245	Do.
Quartz	1,129	384	Do.
Sand and gravel	12,409	13,764	Mainly to Guatemala.
Sulfur, elemental, all forms ...thousand tons	1,637	1,416	United States 793; United Kingdom 250.
Talc, soapstone, and pyrophyllite	41	24	Mainly to United States.
Other nonmetals, n.e.s.: Crude:			
Calcite	210	144	All to United States.
Perlite	631	221	Mainly to Colombia.
Strontium minerals	2,832	3,615	Mainly to United States.
Wollastonite	95	131	All to United States.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and natural bitumen	285	238	United Kingdom 132; Guatemala 74.
Carbon black	216	6	All to Guatemala.
Coal and coke	18	1,182	Mainly to United States.
Gas, hydrocarbon, natural ...million cubic feet	54,365	49,338	All to United States.
Petroleum:			
Crude ...thousand 42-gallon barrels	9,901	-------	
Refinery products:			
Gasoline ...do	318	-------	
Distillate fuel oil ...do	24	21	United States 10; Liberia 2; Norway 2.
Residual fuel oil ...do	7,727	14,157	Mainly to United States.
Lubricants ...do	374	99	Mainly to Guatemala.
Mineral jelly and wax ...do	8,784	11,354	Mainly to United States.

r Revised.

Source: Secretaría de Industria y Comercia, Dirección General de Estadística. Anuario Estadística del Comercio Exterior de los Estados Unidos Mexicanos, 1968, 784 pp.; 1969, 815 pp.

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Table 3.—Mexico: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum:			
Bauxite and concentrate	13,546	11,950	Mainly from United States.
Oxide (alumina)	48,069	44,682	Do.
Metal, including alloys, all forms	4,095	9,150	United States 6,369; United Kingdom 2,075.
Antimony, metal, including alloys, all forms	3	-------	
Arsenic:			
Trioxide, pentoxides, and acids	(1)	192	Mainly from United States.
Metal, including alloys, all forms	13	11	Do.
Natural sulfides	-------	103	All from United States.
Chromium:			
Chromite	28,872	23,464	Mainly from United States.
Oxide and hydroxide	197	351	West Germany 161; United States 85.
Cobalt, oxide and hydroxide	74	102	Canada 50; Belgium-Luxembourg 32.
Copper, metal, including alloys:			
Scrap	49	8	Mainly from United States.
Unwrought	7	21	United States 12; United Kingdom 8.
Semimanufactures	687	765	United States 371; West Germany 227.
Gold, metal, unworked or partly worked troy ounces	11,379	8,618	Mainly from United States.
Iron and steel:			
Ore and concentrate	15,922	128,434	United States 85,639; Brazil 42,794.
Metal:			
Scrap	697,239	460,912	Mainly from United States.
Pig iron, ferroalloys and similar materials	r 14,723	7,882	United States 4,623; United Kingdom 2,983.
Steel, primary forms	115,824	139,691	Mainly from United States.
Semimanufactures	166,452	164,119	United States 62,930; Canada 17,923.
Lead:			
Oxides	25	12	Mainly from United States.
Metal, including alloys	80	979	Do.
Magnesium, metal, including alloys, all forms	401	859	Do.
Mercury 76-pound flasks	11	29	United States 18; Netherlands 10.
Molybdenum:			
Ore and concentrate	26	16	All from United States.
Metal, including alloys, all forms	15	8	Mainly from United States.
Nickel:			
Matte, speiss, and similar materials	72	183	United States 110; Canada 65.
Metal, including alloys, all forms	1,506	1,358	United States 645; West Germany 522.
Platinum-group metals, including alloys, all forms:			
Palladium troy ounces	5,621	7,658	Mainly from United States.
Platinum do	1,678	1,772	United States, 1,059; West Germany 598.
Silver, metal, including alloys do	21,283	31,764	Mainly from United States.
Tin:			
Ore and concentrate long tons	1,689	1,984	Bolivia 1,153; United States 608.
Oxide do	50	73	United Kingdom 51; United States 19.
Metal, including alloys, all forms do	86	853	Mainly from United States.
Titanium:			
Ore and concentrate	649	896	Australia 566; United States 278.
Oxides	17	166	Mainly from United States.
Slag and residues	22,360	26,063	All from Canada.
Tungsten, metal, including alloys, all forms	26	10	Mainly from United States.
Uranium, metal	3	3	All from United States.
Zinc, metal, including alloys, all forms	102	65	West Germany 26; United States 18; Belgium-Luxembourg 17.
Zirconium, ore and concentrate	1,279	1,776	Mainly from Australia.
Other:			
Ore and concentrate, n.e.s.	59	12,313	Mainly from United States.
Metals and alloys, n.e.s.	2,762	2,892	Do.
Scrap of nonferrous metals, n.e.s.	99	208	Do.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	855	749	United States 342; West Germany 222.
Dust and powder of precious and semi-precious stones kilograms	1,632	23	All from United States.
Grinding and polishing wheels and stones	142	99	United States 62; West Germany 15.
Asbestos, crude	30,568	33,819	Mainly from Canada.
Barite and witherite	r 745	819	United States 427; East Germany 209; West Germany 172.
Boron materials, oxide and acid	1,572	1,292	Mainly from United States.
Cement	3,089	2,594	Do.
Chalk	(1)	50	Do.

See footnotes at end of table.

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Table 3.—Mexico: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS—CONTINUED			
Clays and clay products (including all refractory brick): Crude clays:			
Fuller's earth	600	323	All from United States.
Kaolin (china clay)	13,102	17,632	Mainly from United States.
Refractory	82,427	75,037	Do.
Other	568	824	Do.
Cryolite	45	96	Belgium-Luxembourg 59; United States 27.
Diamond:			
Gem, not set or strung—carats	6,180	12,160	Belgium-Luxembourg 4,690; Netherlands 4,355; United States 2,145.
Industrial—do	35,000	50,000	Mainly from United States.
Diatomite	49	228	Do.
Feldspar	1,792	2,719	All from United States.
Fertilizer materials, manufactured:			
Nitrogenous	124,525	164,193	United States 26,585; Japan 26,012; Belgium-Luxembourg 22,570; Netherlands 20,000; United Kingdom 19,736; Chile 17,000.
Phosphatic	342,531	361,586	All from United States.
Potassic	44,523	61,388	United States 49,025; West Germany 10,036.
Other	4,868	5,827	Mainly from Chile.
Fluorspar	2	13	Mainly from United States.
Graphite, natural	62	152	Do.
Gypsum	15,685	11,888	Do.
Lime	10,306	12,152	Do.
Magnesite	31,762	19,106	Do.
Mica, all forms	187	330	Do.
Pigments, mineral, including processed iron oxides	149	259	Sweden 168; United States 95.
Precious and semiprecious stones, except diamond—kilograms	r 1,684	1,629	Netherlands 577; Switzerland 504; United States 419.
Salt	5,415	476	Mainly from United States.
Sodium and potassium compounds:			
Caustic soda	r 34,161	8,039	Do.
Potassium hydroxide	1,064	2,162	United States 1,183; West Germany 500.
Stone, sand and gravel:			
Dimension stone, roughly worked	6,594	5,661	Mainly from Italy.
Dolomite	50	50	All from United States.
Gravel, crushed, and paving stone	732	2,450	Mainly from United States.
Sand	107,228	121,669	Do.
Quartz	58	268	Do.
Sulfur	312	428	Do.
Talc and pyrophyllite:			
Talc:			
Crude	35,553	52,520	Do.
Powdered	391	325	United States 182; France 101.
Pyrophyllite	120	58	All from United States.
Vermiculite	393	483	Do.
Other nonmetallic minerals	2,690	1,839	Mainly from United States.
MINERAL FUELS AND RELATED MATERIALS			
Coal	61,918	69,863	Do.
Coke	147,321	303,714	Do.
Gas, hydrocarbon:			
Natural gas—million cubic feet	9,669	11,018	All from United States.
Natural gas liquids—thousand 42-gallon barrels	6,975	6,499	Mainly from United States.
Petroleum:			
Crude—do	524	(1)	All from United States.
Refinery products:			
Gasoline—do	705	608	Netherlands Antilles 342; Netherlands 153; United States 82.
Kerosine—do	166	209	Mainly from United States.
Distillate fuel oil—do	61	79	Do.
Residual fuel oil—do	1,727	1,239	All from United States.
Lubricants—do	199	602	Mainly from United States.
Asphalt—do	4	3	Do.
Mineral jelly and wax—do	213	204	Do.
Other—do	637	665	Do.
Mineral tar and other coal, petroleum, or gas-derived crude chemicals	15,247	22,630	Do.

r Revised.
1 Less than ½ unit.

Source: Secretaría de Industria y Comercio, Dirección General de Estadística. Anuario Estadística del Comercio Exterior de los Estados Unidos Mexicanos, 1968, 784 pp.; 1969, 815 pp.

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COMMODITY REVIEW

METALS

Aluminum.—Alumex, S.A. de C.V., owned by American Metal Climax, Inc., and Boise Cascade Corp., announced expansion plans which would include the addition of a continuous caster and rolling mill to meet increased demand for aluminum sheet products in Mexico. Part of the total of $1.15 million cost will be financed by Hunter Engineering Co. and the First Chicago International Banking Corp., with a guarantee by the Export-Import Bank. Hunter will supply the equipment. Alumex began production output of sheet, coil, and other products in 1967.

Alcan Aluminio, S.A., planned to double its capacity to over 10,000 tons a year at a cost of $2.8 million. The company's product range includes aluminum sheet, plate, extrusions, foil, tubing, powder, and paste.

Copper.—Toward yearend, the Mexican Government authorized the formation of a new company, Mexicana de Cobre, S.A., to exploit the copper resources of the La Caridad property in eastern Sonora. Initial capitalization was around $25 million. Total investment will probably amount to $240 million.

Sixteen percent of the interest will be held by the Comisión de Fomento Minero (a Government entity) and 49 percent by Asarco Mexicana, S.A., which in turn is owned to the extent of 49 percent by American Smelting and Refining Co. The remaining shares will be distributed mainly to Mexican interests.

Reserves at La Caridad were put at 600 million tons of ore containing 0.76 percent copper and 0.016 percent molybdenum. After the removal of 40 million tons of overburden, the stripping ratio at the open pit mine was expected to be 1 to 1.

Initial plans called for production of 30,000 tons of ore daily, equivalent to 75,000 tons of blister copper annually. Concentrating and smelting facilities were planned and will be supplied with power and water from two dams located some 20 kilometers northeast of the mine. A railway spur, paved access road, and a township to accommodate 8,000 persons, will be required.

Cía. Minera de Nacozari, S.A. (CMN), found indications of another large, disseminated copper prospect near La Caridad, Sonora. The company was driving an adit to obtain a bulk sample for metallurgical testing. CMN was also participating in a joint exploration program for copper at Bella Esperanza, Sonora.

East of Nacozari, the Consejo de Recursos Naturales No Renovables, a Government agency, was diamond drilling a low-grade porphyry copper deposit in the Los Alisos district.

Buttes Gas and Oil Co. and its Mexican partners were exploring a near-surface disseminated copper deposit in the State of Michoacán. Initial assays averaged about 0.60 percent copper.

Another porphyry copper prospect was being evaluated by Cía. Minera Coronado, S.A., northwest of Alamos, Sonora. The company's program called for 50 drill holes, each 300 feet in depth.

Asarco Mexicana, S.A., was expanding its copper smelter in San Luis Potosí; Asarco also planned to build an electrolytic copper refinery, but details as to capacity and location were not announced.

Iron Ore.—Cía. Fundidora de Fierro y Acero de Monterrey, S.A. (Fundidora), was to develop an iron ore deposit at Hercules, Coahuila, through its subsidiary, Minera del Norte, S.A. Total cost of the project was estimated at about $4.6 million. The International Finance Corp. of the World Bank Group was to supply $1.5 million (guaranteed by Fundidora). The remaining funds were to be supplied by local sources.

A minimum of 64 million tons of ore had been proved, with exploratory drilling still in progress; probable ore reserves were calculated at an additional 17 million tons. Ore grade was put at about 60 percent Fe with 0.75 percent phosphorus and 0.1 percent sulfur.

Fundidora also planned a pelletizing plant at the Hercules mine; pelletized feed to its new blast furnace was expected to raise output from 2,000 to 3,000 tons a day.

Hojalata y Lámina, S.A., expected to complete Mexico's first pelletizing plant early in 1970. The plant, costing around $16 million, was planned to produce 1.1 million tons of pellets annually from ore supplied from the Las Encinas mine at Pihuamo, Jalisco.

Total Mexican reserves of iron ore in all

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categories were put at 705 million tons with an average iron content of 50 percent. Proven ore reserves were considered adequate to supply projected demand to the year 1990.

Iron and Steel.—An integrated steel company known as Siderúrgica Las Truchas, S.A., was formed at mid-year; initial capital of $4 million was contributed directly and indirectly by the Mexican Government except for 12 percent paid in by Ingenieros Civiles Asociados, a large domestic construction firm. The steel plant will be built at Las Truchas, Michoacán, and will use ore from the nearby Las Truchas deposit, and from the Plutón deposit situated in the area but in the State of Guerrero. Other deposits, which may be drawn upon, are La Guayabera, Los Pozos, and La Mata de Bule, all near the Michoacán coast. About 70 million tons of ore are available in the district.

It is expected that 900,000 tons of iron ore will be required to afford the initial planned capacity of 500,000 tons of finished and semifinished steel products.

Power will be supplied by a generating plant under construction at Villita, Michoacán; annual potential of the plant is rated at 1,320 million kilowatt hours.

The metallurgical complex will be connected by a proposed railway to Puerto Necesidad, to be built at the mouth of the Balsas River to bring in needed supplies and export the products.

The entire complex is planned to be in production between 1975 and 1980.

Lead and Zinc.—Asarco Mexicana, S.A., increased production capacity of its lead-zinc sulfide ore facilities at Plomosas from 3,000 tons to 13,000 metric tons monthly. A new 1,088-foot shaft was being sunk, and underground crushing equipment was to be installed.

Rehabilitation and expansion of the company's Santa Bárbara unit in the State of Chihuahua was in progress. Concentrator capacity was to be increased from 1,350 to 2,300 metric tons daily. A production shaft was being sunk at the San Diego mine. The shaft has an 11 by 19-foot cross section and is to be 2,288 feet in depth; an underground crusher will be installed.

In addition, Asarco Mexicana was building a new 600-metric-ton-per-day concentrator at its San Martin, Zacatecas, unit to replace the present 250-ton-per-day installation.

The company also decided to build an electrolytic zinc refinery, but details of capacity and location were not announced.

Silver.—Pure Silver Mines, Ltd. (A Canadian concern), continued exploration work on various properties along parts of La Veta Madre vein system in Guanajuato. The Peregrina property had some 300,000 tons of ore indicated containing about 15 ounces of silver and 0.14 ounces of gold per ton. It was expected that work would continue on the Cebada property, where drilling gave promise of economic values.

Development ore from Peregrina was being milled in local plants, but if the prospecting program to be carried out is successful, a 1,000-ton-per-day mill will be built by the company at La Veta Madre, one of the better prospects.

Ore indicated on three of seven separate properties totaled 1 million tons. Overall average value was probably in the range of 14 to 15 ounces of silver a ton, with recoverable gold values.

Pure Silver Mines has a 30-percent interest in the prospects, with Mexican interests holding 70 percent.

Other old and new silver properties were under active exploration or development. Sampling was in progress on a property near Temoris, Chihuahua.

Cía. Minera Santa Cecilia, S.A., started work on a mill to treat 70 tons of ore daily at its mine near Chiapas, Chihuahua.

Also in Chihuahua, at Maguarichi, Impulsora Minera Mexicana, S.A., was reopening the old Maguarichi mine.

It was reported that the Mexican Government (67 percent) and Minero Frisco, S.A. (33 percent) would form a company to develop a silver deposit of 750,000 tons of proven ore at Lampazos, Sonora. Planned production of silver was set at 150 kilograms daily.

Uranium.—The first uranium plant in Mexico was inaugurated on July 2 at Aldama, Chihuahua. Exploitation of deposits of fissionable materials was reserved for the Government in 1965; the plant and mine is a joint venture of Comisión Nacional de Energía Nuclear (CNEN) and Comisión de Fomento Minero (CFM) CNEN was also working on two deposits in the State of San Luis Potosí and was

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preparing proposals to exploit two deposits in Durango.

Proven uranium reserves were reported at 4.4 million tons of ore, containing 2,800 tons of uranium oxide.

NONMETALS

Asbestos.—Cía. Nacional de Asbestos, S.A., was formed to mine and process chrysotile asbestos at a site located 20 kilometers west of Ciudad Victoria, Tamaulipas. The Mexican Government will hold a 51-percent share in the enterprise, and the remaining interest will be available to public or private subscribers. Reserves were established at 1.2 million tons of ore, and a plant to treat 500 tons of ore per day was planned which should be in operation early in 1971.

Cía. Minera Pegaso, S.A., jointly owned by Freeport Sulphur Co. and Mexican interests, reported discovery of a chrysotile asbestos deposit north of Miubérrima, Oaxaca. The deposit was still being evaluated at yearend; 12 drill holes had found asbestos-bearing rock over thicknesses ranging from 93 to 385 feet.

Mexico imported over 30,000 tons of asbestos in 1968, and it was estimated that the planned production of Cía. Nacional alone would satisfy 15 to 20 percent of the country's annual requirements. Cía. Pegaso may add substantially to this estimate.

Barite.—Negociación Minera Eulalio Gutierrez put into operation a plant to concentrate, grind, and bag barite at the rate of 150 tons a day. The plant is located at the mine in the Santa Maria mountains, near Saltillo, Coahuila.

Fertilizer Materials.—The fertilizer plant of Fertilizantes Fosfatados Mexicanos, S.A., was readied for production early in 1969. The plant was owned primarily by Mexican interests, with Pan American Sulphur Co. of Houston, Tex. holding a 34-percent share. Annual planned capacity of the plant was 550,000 tons of phosphoric acid and 204,000 tons of superphosphate; only a part of this capacity will be used in the intial stages of production. Sales contracts were reportedly in effect with users in Australia, Philippines, and India.

Gases, Industrial.—Union Carbide Mexicana, S.A., opened its oxygen-nitrogen-argon plant, located near Monterrey. Combined gas output was 140 tons per day; oxygen was being supplied to Cía. Fundidora de Fierro y Acero de Monterrey, S.A., for use in its steelmaking facilities.

Magnesia.—Domestic demand for magnesia will likely be satisfied by addition of the second oxide plant at yearend. Quimica del Rey, S.A., an affiliate of Industrias Peñoles, S.A., will produce refractory-grade magnesia from brines and dolomites at its plant located at Laguna del Rey, Coahuila. Output was planned for 35,000 tons annually.

During 1969, Quimica del Mar, S.A., located at Ciudad Madero, Tampico, operated at 85 percent of its maximum capacity of 50,000 tons annually; capacity output was expected for 1970. The company produces refractory-grade dead burned magnesia from sea water. It is an affiliate of General Refractories Co., with some Mexican interest.

MINERAL FUELS

Coal.—Of interest to the coal and metallurgical industries was a bulletin[3] published by the Mexican Government in 1969. The work deals briefly with the historical use of coal in Mexico, future supply, needs, and reserves.

A revision of previous figures puts total estimated coal reserves in the State of Coahuila at 2,198 million tons; of the total, 243 million tons are measured, and 828 million tons are "recoverable." Commercial deposits in other States are known to exist.

Petroleum.—Petróleos Mexicanos (Pemex) became the only producer and processor of petroleum and natural gas in Mexico by completing purchase agreements for all the remaining privately operated contract hydrocarbon production and sales rights in the country. The rights included those held by the Pauley-Continental petroleum interests, Sharmex, S.A. de C.V., Isthmus Development Co., and Pauley Noreste. All properties were paid for by Pemex and included reimbursement for profits the companies would have made if the contracts had been allowed to run their full term. In the case of Pauley Noreste, Pemex also assumed contract gas sales to Texas Eastern Transmission Co., which will run to 1977.

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[3] Salas, Guillermo P., and Jesús Ojeda Rivera. Geología, Reservas y Petrografía de los Carbones Mexicanos para la Siderurgia (Geology, Reserves and Petrography of Mexican Metallurgical Coal) Consejo de Recursos Naturales No Renovables. Mexico, D.F. Bulletin No. 70, 1969. 52 pp.

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Total production in 1969 was 168,378,985 barrels made up of crude oil, 149,661,153 barrels; condensate, 199,217 barrels; and natural gas liquids, 18,518,615 barrels. Production of natural gas amounted to 609,000 million cubic feet, equivalent to 122 million barrels of crude oil in calorific value.

A total of 519 wells were drilled, of which 134 were exploration wells and 385 were development wells. Exploration drilling led to the discovery of 12 new oilfields and 5 new gasfields; in addition, the productive area of 23 older fields was extended. Of the development wells, 225 yielded petroleum and 74 were completed as gas wells. Drilling in the offshore Marine Golden Lane indicated that the productive fairway was about 55 kilometers in length.

Noncommercial shows of oil and gas, which might lead to future discoveries, were encountered in the States of Vera Cruz, Puebla, Chihuahua, Coahuila, and Hidalgo.

Mexican petroleum reserves at yearend were put at 5,570 million barrels, a slight rise over the preceding year's figure of 5,530 million barrels. At the present rate of consumption, the 1969 reserves were equivalent to about 20 years' supply. The field reserves were divided as follows, in millions of barrels: Crude oil, 2,824; condensate, 419; gas (converted to barrels), 2,328.

Pemex had nearly completed renovation of its fleet and was able to retire two older ships; this left 21 tankers in operation with an average age of 6 operating years. Deadweight tonnage totaled 349,979, with a capacity of 2,720,245 barrels. In 1969, the Pemex fleet transported 70.7 million barrels of products over a total of 1,015,000 miles.

Additions and expansion of ports continued for handling products and petrochemicals.

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The Mineral Industry of Morocco

By Henry E. Stipp [1]

Morocco's output of many major mineral commodities continued to decrease, because of competitive factors in world markets and the decrease in quality of ore reserves at old mines. Although the production of many minerals decreased from that of 1968, their value increased owing to the high prices in world markets. Except for the development of a new lead mine, no major new discoveries of mineral resources have been made recently. The exploration for new mineral deposits generally has been unsuccessful. The Moroccan Government through the Bureau de Recherches et de Participations Minierès (BRPM) was searching for new mineral deposits. It was operating under joint agreements with firms from other nations for the exploration and exploitation of minerals. Benefits of the previously passed legislation on investment were extended to the mining sector at yearend. Mining enterprises became eligible for tax reductions, customs exemptions on some imported materials, accelerated depreciation, equipment premiums, retransfer guarantees on foreign investments, and other benefits. These changes were subsequently made legal in the Bulletin Official of January 26, 1970. Royal Decree No. 2-70-47 of December 31, 1969, Joint Decree of the Ministers of Finance and of Commerce No. 791-69 of December 31, 1969, and several sections of Dahir 1-69-360.

PRODUCTION AND TRADE

The total value of minerals production increased to an estimated $171.1 million in 1969 compared with $170.9 million in 1968. Output of most major mineral commodities (except phosphate rock) decreased from that of 1968; however, the higher price on world markets for a number of nonferrous metals mainly accounted for the slight rise in total value. Statistics on production and trade are contained in the following tables.

A 5-year partial association agreement between Morocco and the European Economic Community became effective September 1. The agreement was expected to stimulate trade between Morocco and West European countries. The major share of Morocco's phosphate fertilizer exports goes to these countries. During 1969 the minerals industry employed directly 26,202 persons.

[1] Physical scientist, Bureau of Mines, Washington, D.C.

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Table 1.—Morocco: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969
METALS			
Antimony concentrate:			
Gross weight	3,178	2,694	3,127
Metal content	1,589	1,212	1,407
Cobalt concentrate:			
Gross weight	17,530	15,179	14,097
Metal content	1,928	1,518	e 987
Copper concentrate:			
Gross weight	8,421	9,521	9,475
Metal content	2,526	3,047	3,032
Iron ore, direct shipping thousand tons	884	r 807	749
Lead concentrate:			
Gross weight	116,336	r 120,570	117,680
Metal content	52,351	72,382	70,608
Metal, primary	21,359	24,166	26,836
Manganese:			
Ore, metallurgical	197,753	86,437	10,444
Ore, chemical	88,385	73,774	120,132
Nickel, content of cobalt ore e	350	(2)	14
Silver, metal, primary thousand troy ounces	773	920	861
Tin:			
Mine output, metal content long tons	10	19	10
Metal, primary do	12	15	e 12
Zinc concentrate:			
Gross weight	82,915	67,620	72,079
Metal content	45,521	31,781	33,877
NONMETALS			
Barite	90,518	78,160	86,940
Cement thousand tons	858	996	926
Clays:			
Smectite and bentonite	33,361	43,759	21,205
Other, including fuller's earth	4,015	4,380	5,050
Fertilizer materials: Crude (natural):			
Phosphate rock thousand tons	9,945	10,512	10,662
Gypsum, crude e do	90	------	NA
Pyrrhotite	353,153	417,851	391,528
Salt, all types thousand tons	20	[3] 41	67
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite thousand tons	482	451	397
Briquets do	(4)	18	17
Gas, natural, marketed million cubic feet	379	382	1,484
Petroleum:			
Crude oil thousand 42-gallon barrels	738	620	410
Refinery products:			
Gasoline do	2,178	2,429	2,668
Kerosine do	506	574	[5] 900
Distillate fuel oil do	3,078	3,050	3,493
Residual fuel oil do	2,897	2,974	3,047
Other, mainly liquefied petroleum gas do	477	573	612
Total do	9,136	9,600	10,720

e Estimate. r Revised. NA Not available.

[1] In addition to commodities listed, Morocco also produces small quantities of copper matte from lead smelting, phosphatic fertilizer, and various quarry products, but production data are not available.

[2] Nickel production estimated at 302 metric tons in 1968 revised to none.

[3] Rock salt.

[4] Included with anthracite.

[5] Includes jet fuel.

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Table 2.—Morocco: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968 [1]
METALS			
Aluminum, metal, including alloys, all forms		479	691
Antimony, ore and concentrate		3,324	2,730
Cobalt, ore and concentrate		15,565	18,280
Copper:			
Ore and concentrate		7,558	6,521
Matte		167	25
Scrap and ferroalloys		r 328	480
Iron and steel:			
Ore, direct shipping	thousand tons	916	657
Roasted pyrite		5,130	850
Scrap		34,868	25,340
Ferroalloys		36	------
Semimanufactures		1,050	2,557
Lead:			
Ore and concentrates		86,431	88,089
Unwrought and scrap		20,061	22,747
Magnesium, metal, including alloys: Scrap and ingot		7	7
Manganese, ore and concentrate	thousand tons	215	166
Zinc, ore and concentrate		86,708	79,755
Other:			
Ore and concentrate, n.e.s		3	1
Slags and residues, n.e.s		507	820
Oxides of metals, mainly for paint		1,000	------
NONMETALS			
Barite		89,116	81,587
Cement		16,581	9,345
Clays and clay products (including refractory brick):			
Bentonite		158	125
Fuller's earth		4,199	2,532
Refractory		1,655	1,664
Smectic		21,688	15,306
Fertilizer materials:			
Crude, phosphate rock	thousand tons	9,342	10,082
Manufactured, phosphatic		187,088	239,415
Gypsum and plasters		50,688	67,857
Lime		165	92
Salt and brines		2	1
Stone, sand and gravel:			
Dimension stone and other		6,972	9,257
Crushed rock		1,229	30
Sand, mainly industrial		8,945	8,299
Sulfur: Sulfuric acid		85	------
Other nonmetals, n.e.s		1,907	------
MINERAL FUELS AND RELATED MATERIALS			
Coal and briquets: Anthracite	thousand tons	68	57
Petroleum:			
Refinery products:			
Gasoline	thousand 42-gallon barrels	10	193
Kerosine and jet fuel	do	88	127
Distillate fuel oil	do	62	204
Residual fuel oil	do	7	29
Lubricants	do	(2)	(2)
Liquefied petroleum gas	do	(2)	(2)
Other: Bitumen	do	2	------
Total	do	164	553

r Revised.
[1] Royaume du Maroc. Statistiques Du Commerce Exterieur, 1968. 665 pp.
[2] Less than ½ unit.

Major destinations of selected commodities, 1968

(Thousand metric tons unless otherwise specified)

Commodity		Quantity
Iron ore		657
West Germany		237
Spain		214
Czechoslovakia		108
Lead	metric tons	88,089
France	do	88,089
Phosphate rock		10,082
France		1,787
United Kingdom		1,066
Belgium-Luxembourg		1,007
Zinc	metric tons	79,755
France	do	43,058
United States	do	22,697
Italy	do	9,850

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Table 3.—Morocco: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968 [1]
METALS		
Aluminum:		
Bauxite and concentrate	2,000	1,600
Metal, including alloys, all forms	2,544	2,556
Copper, metal, including alloys, all forms	2,321	2,532
Iron and steel:		
Scrap	5	74
Pig iron, ferroalloys, and similar materials	938	1,655
Semimanufactures	15,527	18,257
Lead, metal, including alloys, all forms	8	6
Manganese, ore and concentrates	------	28
Mercury, 76-pound flasks	4	29
Molybdenum, metal, including alloys, unwrought, kilograms	98	886
Nickel, metal, including alloys, all forms	370	418
Silver, metal, including alloys, all forms, troy ounces	289	3,762
Tin, metal, including alloys, all forms, long tons	274	295
Zinc, metal, including alloys, all forms	978	1,168
Other:		
Slags and residues, metallic	------	2
Oxides of metals, mainly for paint	808	645
NONMETALS		
Abrasives, natural	15	9
Asbestos	2,198	2,224
Barite and witherite	2	------
Boron materials: Borates, sodium, refined	554	671
Cement	8,170	13,191
Chalk	2,847	2,568
Clays and clay products (including refractory brick):		
Crude clays, n.e.s.:		
Fuller's earth	40	45
Kaolin and refractory	14,545	12,639
Smectic	4,647	5,519
Other	274	435
Products	8,027	NA
Diatomite and other infusorial earths	936	730
Fertilizer materials:		
Crude, all types	448	10
Manufactured:		
Nitrogenous	25,353	6,140
Potassic	28,334	37,278
Other, including mixed	13,308	23,064
Ammonia	89,824	104,934
Graphite, natural	8	25
Lime	270	198
Salt and brines	70	41
Sodium and potassium compounds, n.e.s.:		
Caustic soda	6,062	7,559
Caustic potash, sodic, and potassic peroxides	90	70
Stone, sand and gravel:		
Dimension stone	621	343
Dolomite, chiefly refractory grade	658	569
Gravel and crushed rock: Crushed rock	14	164
Sulfur:		
Elemental, all forms	8,384	13,083
Sulfuric acid	11	11
Talc, steatite, soapstone, and pyrophyllite	787	1,203
Other nonmetals, n.e.s.	176	405
Oxides and hydroxides of magnesium, strontium, and barium	(2)	11
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets, thousand tons	57	78
Gas, hydrocarbon (LPG), thousand 42-gallon barrels	12	45
Petroleum:		
Crude, do	8,228	9,276
Refinery products:		
Gasoline, do	91	74
Kerosine, do	246	352
Distillate fuel oil, do	158	139
Residual fuel oil, do	133	54
Lubricants, do	137	152
Mineral jelly and wax, do	68	112
Other: Bitumen and asphalt, do	196	245
Total, do	1,029	1,128

NA Not available.

[1] Royaume du Maroc. Statistiques Du Commerce Exterieur, 1968. 542 pp.

[2] Less than ½ unit.

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COMMODITY REVIEW

METALS

Cobalt.—Technoexport, a U.S.S.R. organization, conducted geologic, geochemical, and geophysical research near the Bou Azzer mine, Ouarzazate, searching for deposits of cobalt minerals.[2] Cobalt concentrates mined in Morocco were shipped to Ugine Kuhlmann Co. in France. The firm formerly recovered about 4 million pounds per year from Moroccan concentrates, but recovery became uneconomical, owing to the declining cobalt content of the concentrates. Reportedly cobalt production in Morocco ceased at yearend.

Copper.—Numerous deposits and occurrences of copper located mainly in the Jebilet, High Atlas, and Anti Atlas mountains were described according to their geology, economic importance, and type of occurrence.[3] BRPM signed an agreement with a French company, Omnium Nord-Africain, and with a Japanese firm, Mitsui Mining and Smelting Co., to explore for copper in eastern Morocco.[4] In February Occidental Ores, a subsidiary of the U.S. firm Occidental Petroleum Corp., closed its operations in the Allous area of the Anti Atlas mountains.[5] Reportedly the deposit was not of significant commercial interest. Reserves of the deposit were estimated at 6.7 million tons of 0.7 percent copper. The Yugoslav firm Interexport, in cooperation with BRPM, carried out drilling at Ouansimi and Agoujal where reserves were estimated at 700,000 tons of 1.6 percent copper and 500,000 tons of 3 percent copper respectively. Interexport withdrew from the project, but BRPM intended to proceed with further exploration.

Iron and Steel.—The Sétolazar mine, which produces ore containing a higher sulfur content than the nearby Uixan mine, suspended operations in February.[6] Mining became uneconomic owing to the low grade of ore and exhaustion of surface veins. Société d'Exploitation des Mines du Rif, operator of the mines, was selecting a foreign engineering firm to supervise reorganizing and reequipping the mines. New plants for desulfurizing and pelletizing the ore, new mining equipment, and a new railway were scheduled for installation. The eight principal iron ore deposits in Morocco were described according to their geologic type, mineralogy, and reserves.[7] The deposits are as follows:

Name	Location	Ore grade [1] (percent)	Reserves (million tons)
Quichane	Near Melilla	60 Fe, 7 SiO_2, 1.5 S, 0.05 P	80
Setolazar	Quichane	54 Fe, 4 SiO_2, 4 S, 0.01 P	11
Tourza Ougnat	Ouarzazate district	52 Fe, 8 SiO_2, 1.04 P	40
Kettara	West of Marrakesh	52 Fe, 11.5 SiO_2, 0.05 P	1
Bou-Ouzel and Bou-Guergour.	Khenifra district	43 Fe, 9.6 SiO_2, 0.01 P, 14.6 BaO, 2.3 MnO_2	82
Ait Amar (Beni Khirane).	Oued Zem district	46 Fe, 15 SiO_2, 0.7 P, 3 Mn	15
Ait Ahmane (Graara)	Bou Azzer	46 Fe, 24 SiO_2	10
Tachilla Ouarzemimen	Agadir district	35 Fe, 26 SiO_2, 0.5 P	10

[1] Fe—iron, SiO_2—silica, S—sulfur, P—phosphorus.

Lead and Zinc.—The Bou Beker mine in northeastern Morocco, which was operated by the Société des Mines de Zellidja, was completely exhausted and closed down.[8] During its lifetime, the mine produced about 400,000 tons each of lead and zinc ore. The mine employed 950 workers just before shut down. The Touissit mine, which also is an important source of zinc ore, was expected to continue operations for some time, but at a declining level of production. In May and June labor troubles occurred at the Qouli, Midbladen, and Djebel Aouam mines, which were shut down for several weeks. Reportedly an agreement was made between the Moroc-

[2] Chronique des Mines et de la Recherche Minière. No. 379, January 1969, p. 4.
[3] Saadi, Moussa. Mines and Geology. Direction des Mines et de la Geologie. Rabat, Morocco, No. 26, 1968, 53 pp.
[4] Mining Journal (London). Exploration—Moroccan Copper Agreement. V. 274, No. 7020, Mar. 6, 1970, p. 202.
[5] U.S. Embassy, Rabat, Morocco. State Department Airgram A-104, June 12, 1969, p. 8.
[6] Work cited in footnote 5.
[7] United Nations. Survey of World Iron Ore Resources. Department of Economic and Social Affairs. 1970, pp. 63, 66.
[8] World Mining, What's Going On In World Mining. V. 5, No. 10, September 1969, p. 48.

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can Government and the Yugoslavian firm Invest-Import for construction of a plant at Rich to produce zinc from calamine by electrolysis. The Ait Labbes mine will be improved for exploitation of the calamine ore. Studies of the lead, zinc, and silver deposits at Bou Madine by U.S.S.R. technicians were completed. It was determined that the mines would not economically support extraction of 530,000 tons per year, and should be worked on a smaller scale. The BRPM and Société des Mines de Zellidja agreed to form a joint company to develop a deposit near Midelt in the Upper Moulouya Valley.[9] The deposit contained an estimated 10 million tons of ore averaging 2.75 percent lead. The joint company Société de Developpement Industriel et Minière de Haute Moulouya will be managed by Zellidja with open-pit mining scheduled to start about mid-1971. Initial ore production will be 3,000 tons per day, which will be concentrated in the flotation plant located at the Bou Beker mine. BRPM recently signed a contract with two Japanese firms, Nittetsu Mining Co. Ltd. and Marubeni Iida Co. Ltd., for development of the Bou Kerzia mine. Concessions for prospecting will be given to the Japanese companies for exploration, which will cost about $400,000.

Manganese.—The Imini manganese mine located in the southern Atlas mountains between Marrakesh and Ouarzazate is operated by Société Anonyme Chérifienne d'Études Minières (SACEM).[10] Outlook for exploitation of chemical-grade ore is better than for metallurgical grade, owing to scarcity and high prices in world markets for chemical ore. SACEM reportedly plans to construct a new beneficiation plant for chemical-grade ore and may discontinue production of metallurgical-grade ore. The sintering plant at Casablanca which operates chiefly on low-grade ore (48 to 50 percent Mn) from Imini, may have to close, owing to a lack of sufficient ore. Nikex, a Hungarian firm, was constructing a beneficiation plant to enrich metallurgical ore mined at Tiouine. The project was scheduled for completion at yearend.

NONMETALS

Barite.—The major share of Morocco's barite output came from the Djebel Irhoud deposit 42 miles southeast of Saji. Reserves were being depleted rapidly, and production, which has been decreasing sharply, came mainly from treatment of old stocks and debris.

Fluorite.—In April BRPM and Omnium Nord-Africain signed an agreement to reactivate the El Hammam mine, which has been closed since 1965. About $200,000 was to be expended on this project.

Phosphates.—A $76.1 million complex for manufacturing phosphoric acid and diammonium phosphate was called for in Morocco's 5-Year Development plan (1968–72).[11] The plan also included investment in new plant, mining equipment, transportation, and port facilities totaling $169 million. Reportedly Morocco was looking for foreign capital and technical assistance to help in expanding its phosphate mining facilities.[12] Office Chérifien des Phosphates (OCP), the Moroccan Government agency which manages the phosphate mines, expected to raise production to 18 million tons of phosphate rock by 1972. OCP awarded a contract to the Czechoslovakian firms Strojexport and Transporta for installation of 5 miles of conveyor belting at the Youssoufia mines.[13] In April OCP called for tenders on two draglines with 6-cubic-yard buckets, three large crawler shovels, and 34 trucks of various capacities. Ifni, ceded to Morocco in 1969, had phosphate deposits estimated at 1,500 million tons.[14] The deposits reportedly extend to the southwest into the Spanish Sahara. New phosphate rock loading facilities at the port of Safi were put into operation in 1969.[15] Facilities included a 656-foot quay and two bucket cranes of 12.5 tons and 7 tons capacity. New storage and loading installations for bagged fertilizers from the Safi fertilizer manufacturing complex also were completed and put into operation.

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[9] Mining Journal (London). New Moroccan Lead Mines. V. 273, No. 7009, Dec. 19, 1969, p. 562.

[10] Industrial Minerals (London). Imini Manganese May Be Completely Chemical. No. 23, August 1969, pp. 32–33.

[11] U.S. Department of Commerce. Overseas Business Reports. OBR 69-66, December 1969, pp. 18–19.

[12] Engineering and Mining Journal. V. 171, No. 2, February 1970, p. 114.

[13] U.S. Embassy, Rabat, Morocco. State Department Airgram A-72, May 6, 1969, p. 4.

[14] Mining and Minerals Engineering. Ifni Phosphate. V. 5 No. 3, March 1969, p. 65.

[15] The British Sulphur Corp. Ltd. Phosphorus and Potassium. No. 40, March–April 1969, p. 50.

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Potash.—Exploration activities in the Khemisset area, under the United Nations Development Program, were being closed down.[16] About 62,339 feet of drilling revealed salt beds from 1 to 3 feet thick, containing up to 12.7 percent potash. The deposit was considered to be uneconomic for development.

MINERAL FUELS

Natural Gas.—Natural gas from the Harich field has been piped to the SCP refinery in Sidi Kacem for use as fuel. Natural gas from the Essouira region (Du Jeer and Kechoula wells) was being used to fuel phosphate drying ovens at Youssoufia. A desulfurizing and dehydrating facility at Kourimat and a natural gas pipeline between Kourimat and Youssoufia began operating in mid-1969.

Petroleum.—In February the recently constructed plants at the Mohammedia refinery of Société Marocaine Italienne de Raffinage (SAMIR) began producing jet fuel and asphalt. A plant owned by a consortuim of Shell Oil Corp., SAMIR, Société Cherifienne Des Pétroles and the Iranian Government was scheduled to begin producing lubricating oil in late 1969.

[16] Work cited in footnote 5.

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The Mineral Industry of the Netherlands

By Joseph B. Huvos [1]

The mineral industry of the Netherlands again registered substantial gains in 1969, with particularly large increases reflected in the petrochemical, natural gas, petroleum refining, and aluminum sectors and impressive gains in the iron and steel and zinc components. Offsetting the higher level of activity in these sectors was the decline in production of tin and lead and the slowdown in the coal and coke industry, as more producing units suspended or cut back operations.

The national economy expanded rapidly in 1969, with industrial production rising 12 percent compared with 11 percent during the previous year.

The main stimulus to expansion of economic activity were the sharp rise in exports and the growth in investments. Worker productivity rose 4 percent compared with a 10.5-percent rise of industrial wages. Consumer prices rose 3 percent.

Crude oil output declined for the fourth consecutive year as offshore drilling indicated only one potential new find. In contrast, expansion of petroleum refining and of pipeline, storage, and distribution facilities continued at a rapid rate, along with growth of chemical and petrochemical installations and associated units.

Exploration for oil and gas in the Netherlands sector of the North Sea was continued by several groups. By yearend only three strikes of gas and one of oil were reported, neither of which had been evaluated for commerical prospects. Meanwhile natural gas production from onshore installations increased substantially for the fifth consecutive year and domestic consumption and exports both attained record levels.

Expansion of the aluminum smelter of Aluminium Delftzijl N.V. (ALDEL) in Delftzijl to reach 90,000 tons in 1970 has continued, while construction started on Groupe Péchiney's 75,000-ton aluminum smelter in Flushing. Koninklijke Nederlandsche Hoogovens en Staalfabrieken N.V. iron and steel facility expansion program continued during the year. Construction of a 100,000-ton-per-year electrolytic zinc plant was started by the Koninklijke Zout Organon (KZO) and the N.V. Hollandse Metallurgische Industrie Billiton concern. Phosphoric acid plant projects were started by Farbwerke Hoechst A.G. of West Germany, Vlissingen, N.V. at Flushing, and by Erste Nederlandsche Kunstmestfabriek (ENCK) at Vlaardingen.

Development of the Rotterdam port area continued in 1969, where Chevron Petroleum Mij (Nederland) N.V. completed expansion of its Pernis oil refinery while Shell Nederland Raffinaderij N.V. started expansion of its oil refinery.

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[1] Foreign mineral specialist, Bureau of Mines, Washington, D.C.

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PRODUCTION

Reflecting the growth of the economy, output of most mineral commodities in the Nederlands increased in 1969. Production of aluminum, pig iron, steel, natural gas, and salt showed the greatest gains, while that of tin metal, coal, and coal products showed the greatest declines.

Table 1.—Netherlands: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Aluminum, metal (primary)	82	49	72
Cadmium, metal e, metric tons	107	r 140	160
Iron and steel:			
Sinter	3,271	3,360	3,381
Pig iron (including blast furnace ferroalloys)	2,588	2,821	3,461
Steel, excluding castings	3,402	3,707	4,713
Steel, semimanufactures:			
Strip	87	108	134
Heavy and medium plates and sheets	1,749	2,033	2,263
Light sections	295	308	365
Wire rods	200	r 267	251
Tubing	12	23	25
Semimanufactures	394	332	678
Total	2,737	3,071	3,716
Lead, metal (primary)	16	17	15
Tin, metal (primary), thousand long tons	14	8	5
Zinc, metal (primary)	39	42	47
NONMETALS			
Cement	3,349	3,486	3,296
Fertilizers:			
Nitrogenous, N_2 content	737	890	875
Phosphatic, P_2O_5 content	206	264	250
Salt, all types	1,926	2,414	2,669
Sulfuric acid	1,170	1,376	1,511
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	75	77	81
Coal, anthracite and bituminous	8,065	6,663	5,554
Coke, all types	3,332	2,931	2,032
Fuel briquets, all grades	1,118	1,054	1,047
Gas:			
Manufactured, all types, million cubic feet	93,153	87,318	NA
Natural, gross production [1], do	253,731	514,172	773,164
Peat e	400	400	400
Petroleum:			
Crude oil	2,265	2,145	2,022
Refinery products:			
Aviation fuels	1,027	1,259	1,763
Motor gasoline	2,189	3,648	4,098
Kerosine	928	1,172	1,000
Residual fuel oil	14,276	16,146	21,348
Distillate fuel oil	8,075	9,565	13,588
Liquefied petroleum gases	519	528	619
Lubricants	321	278	502
Bitumen	673	593	652
Refinery gases	34	NA	NA

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Converted from normal cubic meters at the rate of 35.314 cubic feet per cubic meter.

TRADE

Foreign trade of the Netherlands maintained for the second year its improving balance, as exports covered about 90 percent of imports. During 1969 total exports of roughly $10 billion were up about 20 percent, while imports were up 18 percent to about $11 billion.

For mineral commodities, imports at $2.5 billion exceeded exports of $1.8 billion in 1969, with imports and exports up 20 to 23 percent, respectively, as compared with 1968 levels.

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Table 2.—Netherlands: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum:			
Bauxite and alumina	40	4,816	West Germany 1,302; Italy 727; Mexico 637; Japan 566.
Metal, including alloys:			
Scrap	10,216	11,832	West Germany 10,703; Belgium-Luxembourg 633.
Unwrought	25,597	43,722	West Germany 21,461; Belgium-Luxembourg 10,933; Italy 7,863.
Semimanufactures	19,060	26,975	West Germany 11,153; Belgium-Luxembourg 4,946; United Kingdom 1,676.
Bismuth, including alloys, all forms	214	148	West Germany 38; France 35; Italy 19.
Cadmium, including alloys, all forms	252	303	West Germany 203; Belgium-Luxembourg 90.
Chromium:			
Chromite	3,320	2,771	Italy 923; France 875; West Germany 401.
Oxides and hydroxides	54	402	Italy 290; France 75.
Cobalt, including alloys, all forms	157	44	Japan 17; United Kingdom 13.
Columbium and tantalum, tantalum, including alloys, all forms	4	2	NA.
Copper, metal, including alloys:			
Scrap	34,213	30,637	West Germany 15,816; Belgium-Luxembourg 12,729; France 950.
Unwrought	6,265	10,682	West Germany 5,381; East Germany 2,759; Belgium-Luxembourg 655.
Semimanufactures	13,516	18,368	West Germany 6,305; United States 5,637; Belgium-Luxembourg 2,797.
Gold [1] thousand troy ounces	742	2,328	Belgium-Luxembourg 892; West Germany 844; France 539.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	3	3	Belgium-Luxembourg 1; West Germany 1.
Roasted pyrite do	90	70	All to West Germany.
Metal:			
Scrap do	566	711	West Germany 586; Belgium-Luxembourg 69.
Pig iron and ferroalloys [2] do	297	122	France 57; Belgium-Luxembourg 29; West Germany 18.
Steel, primary forms do	816	741	West Germany 233; Belgium-Luxembourg 162; Spain 80.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	328	386	West Germany 146; United Kingdom 74; Belgium-Luxembourg 35.
Universals, plates and sheet do	972	1,120	West Germany 265; United States 241; United Kingdom 121; France 112.
Hoop and strip do	67	108	West Germany 80; Denmark 7; Italy 4; Belgium-Luxembourg 4.
Rails and accessories do	10	11	West Germany 7; Indonesia 2.
Wire do	27	30	West Germany 9; United States 5; France 4.
Tubes, pipes and fittings do	211	202	West Germany 71; Belgium-Luxembourg 28; France 14; Iran 10.
Castings and forgings do	4	4	Belgium-Luxembourg 2; West Germany 1.
Lead:			
Oxides	1,914	2,437	Belgium-Luxembourg 1,676; Czechoslovakia 481; Algeria 123.
Metal:			
Scrap	6,650	8,153	Belgium-Luxembourg 4,655; West Germany 3,327.
Unwrought	11,385	16,608	West Germany 11,180; Belgium-Luxembourg 3,573.
Semimanufactures	2,012	1,620	Belgium-Luxembourg 353; Norway 292; United States 243; West Germany 126.
Magnesium, including alloys, all forms	262	318	West Germany 179; United States 109.
Manganese:			
Ore and concentrates	18,732	21,783	West Germany 4,401; Italy 3,437; France 1,866; Belgium-Luxembourg 1,436.
Oxide	1,718	3,066	Italy 772; Belgium-Luxembourg 524; West Germany 434; United Kingdom 314.
Mercury 76-pound flasks	1,131	667	West Germany 232; Republic of South Africa 116; Belgium-Luxembourg 87.
Molybdenum, including alloys, all forms	91	87	West Germany 35; France 14; Japan 8; Belgium-Luxembourg 8.
Nickel:			
Oxide and hydroxide	36	140	West Germany 50; Austria 30; Poland 20; Czechoslovakia 19.

See footnotes at end of table.

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Table 2.—Netherlands: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS—Continued			
Nickel—Continued			
Metal, including alloys:			
Scrap	2,170	2,236	West Germany 1,026; United Kingdom 469; Sweden 329.
Unwrought and semimanufactures	1,382	1,445	Mainland China, 523; West Germany 351.
Platinum-group metals, all forms troy ounces	24,434	8,841	West Germany 2,186; United Kingdom 1,768; Japan 997; France 932.
Silver, metal:			
Unwrought thousand troy ounces	1,761	1,660	France 844; Belgium-Luxembourg 640.
Semimanufactures do	293	45	West Germany 42.
Tellurium, elemental, and arsenic	2	6	West Germany 5.
Tin, metal, including alloys:			
Scrap do	r 322	579	West Germany 303; United Kingdom 229.
Unwrought do	r 11,914	9,319	West Germany 3,747; France 1,436; United States 929.
Semimanufactures do	r 257	342	Belgium-Luxembourg 132; Norway 51.
Titanium, dioxide	9,043	14,621	West Germany 2,973; Italy 2,845; France 1,682.
Tungsten:			
Ore and concentrate	249	270	West Germany 103; Belgium-Luxembourg 49; United Kingdom 38.
Metal, including alloys all forms	113	210	West Germany 117; United States 21; France 14.
Vanadium:			
Ore and concentrates (including molybdenum, etc. ores)	10,526	12,648	West Germany 3,391; Austria 1,773; Italy 1,525; United Kingdom 1,514.
Zinc:			
Ore and concentrate	7,725	20,391	Belgium-Luxembourg 13,058; France 1,782.
Oxide	8,915	11,051	West Germany 1,638; Belgium-Luxembourg 1,231; Italy 875.
Metal, including alloys:			
Scrap	8,050	8,527	France 7,958; West Germany 345.
Unwrought	27,410	24,785	West Germany 14,361; France 3,223; Denmark 2,497.
Semimanufactures (include zinc dust)	1,095	1,518	West Germany 980; Belgium-Luxembourg 293.
Other:			
Ore and concentrate	1	------	
Ash and residues containing nonferrous metals:			
Iron and steel thousand tons	156	103	Belgium Luxembourg 78; West Germany 24.
Lead	5,460	4,667	Belgium-Luxembourg 2,499; West Germany 2,133.
Tin long tons	806	505	West Germany 341; United Kingdom 106.
Zinc	7,824	6,883	West Germany 3,397; Belgium-Luxembourg 2,630; France 427.
Other	11,384	11,459	West Germany 9,003; Belgium-Luxembourg 1,691.
Metals, including alloys, all forms:			
Metalloids:			
Selenium	14	7	All to Canada.
Silicon	39	NA	
Other	NA	6	West Germany 5; Belgium-Luxembourg 1.
Alkali, alkaline earth, and rare earth metals	1	1	All to Belgium-Luxembourg.
Oxides of strontium, barium and magnesium	249	973	Belgium-Luxembourg 892; France 64.
Metals, including alloys, all forms	689	648	West Germany 301; Belgium-Luxembourg 167.
NONMETALS			
Abrasives, natural n.e.s:			
Pumice, emery, natural corundum	4,968	5,259	West Germany 693; France 440; Belgium-Luxembourg 325.
Dust and powder of precious and semiprecious stones thousand carats	1,118	1,273	West Germany 449; France 222; Italy 215.
Grinding and polishing stones	818	1,005	West Germany 385; United Kingdom 109; France 104.
Asbestos	54	55	Belgium-Luxembourg 41.
Borates, crude natural	222,056	246,653	West Germany 87,808; United Kingdom 51,783; France 43,742.
Cement	43,822	25,784	West Germany 18,443; Belgium-Luxembourg 6,855.

See footnotes at end of table.

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Table 2.—Netherlands: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
NONMETALS—Continued			
Chalk	42,828	38,078	Belgium-Luxembourg 36,382; West Germany 1,427.
Clays and clay products:			
Crude clays:			
Kaolin	147	21,126	Belgium-Luxembourg 21,007.
Refractory	1,835	2,387	Sweden 874; Belgium-Luxembourg 672; Denmark 336.
Other—thousand tons	86	108	West Germany 76; Belgium-Luxembourg 29.
Products:			
Refractory including nonclay bricks	10,421	6,660	West Germany 2,681; Belgium-Luxembourg 2,038.
Nonrefractory—thousand tons	590	652	West Germany 508; Belgium-Luxembourg 119.
Diamond, all grades:			
Gem, not set or strung—thousand carats	1,514	1,220	NA.
Industrial—kilograms	804	9,046	West Germany 9,041.
Diatomite and other infusorial earths	271	1,309	Belgium-Luxembourg 1,084.
Feldspar and fluorspar	501	1,048	Belgium-Luxembourg 777; Australia 180.
Fertilizer materials:			
Crude: Phosphate rock	505	227	Kenya 151.
Manufactured:			
Nitrogenous—thousand tons	r 742	876	Mainland China 387; United Kingdom 97.
Phosphatic:			
Thomas slag	224	26	Belgium-Luxembourg 26.
Superphosphate and other—thousand tons	141	117	France 56; West Germany 1.
Potassic	1,099	708	Congo (Kinshasa) 256; Australia 71; Belgium-Luxembourg 70.
Other, including mixed—do	524	670	France 177; Belgium-Luxembourg 17.
Ammonia, anhydrous	82,999	128,617	Belgium-Luxembourg 94,447; West Germany 16,960.
Lime	3,043	7,638	Belgium-Luxembourg 5,612; West Germany 1,419.
Magnesite	17,999	16,911	West Germany 5,961; France 1,077; Belgium-Luxembourg 1,029.
Mica	100	85	Belgium-Luxembourg 67; Sweden 18.
Pigments, mineral including processed iron oxides	306	470	United Kingdom 193; Ceylon 57; Australia 40.
Salt—thousand tons	1,152	1,422	Belgium-Luxembourg 599; Sweden 382; Finland 153.
Sodium and potassium compounds n.e.s.:			
Caustic potash	44	45	Spain 9.
Stone, sand and gravel:			
Dimension stone:			
Unworked:			
Building stone unworked including slate	1,856	1,827	Belgium-Luxembourg 1,331; West Germany 455.
Calcareous, including gypsum and plasters	747	434	Belgium-Luxembourg 335.
Worked: Building stone worked including slate and natural paving stone	9,489	4,863	Belgium-Luxembourg 4,159; West Germany 617.
Gravel and crushed rock—thousand tons	1,283	2,075	Belgium-Luxembourg 1,677; West Germany 394.
Quartz and quartzite	9,334	2,846	Belgium-Luxembourg 1,608; West Germany 1,095.
Sand, excluding metal bearing—thousand tons	6,974	6,998	Belgium-Luxembourg 6,416; France 296; West Germany 177.
Sulfur:			
Elemental, all forms	2,544	833	Belgium-Luxembourg 327.
Sulfur dioxide	916	786	Belgium Luxembourg 32.
Sulfuric acid, oleum—thousand tons	90	56	West Germany 22; Belgium-Luxembourg 17.
Talc and steatite	142	175	Belgium-Luxembourg 15; Denmark 8.
Other nonmetals, n.e.s.—thousand tons	169	208	Belgium-Luxembourg 110; West Germany 64; France 22.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	78	37	Belgium-Luxembourg 19.
Carbon black	66,394	68,447	France 20,877; West Germany 12,642; Sweden 6,951.

See footnotes at end of table.

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Table 2.—Netherlands: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
MINERAL FUELS AND RELATED MATERIALS—Continued			
Coal and briquets:			
Anthracite and bituminous coal thousand tons	1,935	1,975	Belgium-Luxembourg 1,077; France 585.
Briquets of anthracite and bituminous coal do	743	801	West Germany 298; Belgium-Luxembourg 282; France 196.
Lignite briquets do	12	10	NA.
Coke and semicoke do	1,998	1,497	Belgium-Luxembourg 982; France 250.
Gas, hydrocarbon: Natural including liquefied petroleum gas do	421	437	Belgium-Luxembourg 167; West Germany 83; France 62.
Hydrogen, helium, and rare gases	475	336	Belgium-Luxembourg 203; Sweden 45; France 35.
Petroleum:[3]			
Crude thousand tons	1	19	All to West Germany.
Refinery products:			
Gasoline do	3,460	3,567	Belgium-Luxembourg 352; Sweden 121; United States 76.
Kerosine, including jet fuel do	732	861	United Kingdom 418; Denmark 90; West Germany 77.
Distillate fuel oils do	4,475	4,828	West Germany 1,852; Sweden 892; Belgium-Luxembourg 511.
Residual fuel oils do	8,731	9,441	United Kingdom 1,476; Belgium-Luxembourg 1,162; West Germany 952.
Lubricants do	425	474	United Kingdom 111; Sweden 47; Belgium-Luxembourg 44.
Mineral jelly and wax do	29	36	United Kingdom 13; West Germany 9.
Other:			
Petroleum coke do	8	1	All to United Kingdom.
Bituminous mixtures do	318	202	West Germany 89; Sweden 20; Denmark 15; Switzerland 11.
Mineral tar and coal, petroleum, or gas derived crude chemicals do	151	197	West Germany 65; Belgium-Luxembourg 43; United States 24.

r Revised. NA Not available.
[1] Excluding gold coin and gold and alloys shipped by post.
[2] Including sponge iron, shot grit, pellets powder, spiegeleisen and ferromanganese.
[3] Includes bunkers for foreign ships and aircraft. Excludes reexports and bonded storage.

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Table 3.—Netherlands: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum:			
Bauxite	16,589	40,943	Greece 38,268; Guyana 2,159.
Alumina	76,403	121,708	Surinam 100,817; West Germany 13,465.
Metal, including alloys:			
Scrap	4,588	8,783	West Germany 3,255; Belgium-Luxembourg 2,336.
Unwrought, including alloys	19,419	33,225	France 5,984; West Germany 5,195; Canada 4,853.
Semimanufactures	37,105	41,280	West Germany 18,727; Belgium-Luxembourg 14,520.
Antimony, including alloys, all forms	r 147	146	Belgium-Luxembourg 58; Mainland China 32; Czechoslovakia 31.
Arsenic, oxides and acids	965	947	Belgium-Luxembourg 787; France 142.
Bismuth, including alloys, all forms	260	235	Japan 54; United States 51; Belgium-Luxembourg 42.
Cadmium, including alloys, all forms	171	349	Belgium-Luxembourg 95; Japan 79; U.S.S.R. 65.
Chromium:			
Chromite	5,952	3,288	Republic of South Africa 2,055; West Germany 558; Greece 265.
Oxide and hydroxide	741	1,058	U.S.S.R. 456; West Germany 407; France 138.
Metal, including alloys, all forms	8	16	United Kingdom 10; West Germany 6.
Cobalt:			
Oxides and hydroxides	283	188	Belgium-Luxembourg 149; United Kingdom 32.
Metal, including alloys, all forms	238	177	Belgium-Luxembourg 148; United Kingdom 18.
Columbium and tantalum, tantalum	2	6	United States 3; Belgium-Luxembourg 2.
Copper, metal including alloys:			
Scrap	10,785	7,699	West Germany 3,243; Belgium-Luxembourg 2,728.
Unwrought	33,619	41,865	Belgium-Luxembourg 12,701; Zambia 6,861; West Germany 5,183.
Semimanufactures	50,057	62,633	Belgium-Luxembourg 37,865; West Germany 15,477.
Gold [1] thousand troy ounces	175	111	Denmark 55; Italy 24; Lebanon 17.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	3,641	4,359	Liberia 1,231; Sierra Leone 922; Brazil 709.
Roasted pyrite do	------	3	NA.
Metal:			
Scrap thousand tons	164	154	Belgium-Luxembourg 102; West Germany 32.
Pig iron and ferroalloys [2] do	r 50	56	Norway 19; West Germany 9; Belgium-Luxembourg 5.
Ferroalloys, other do	10	12	Norway 6; West Germany 3; U.S.S.R. 2.
Steel, primary forms do	429	327	West Germany 177; Norway 55; Belgium-Luxembourg 33.
Semimanufactures:			
Bars, rods, sections do	1,173	1,268	Belgium-Luxembourg 644; West Germany 444; France 120.
Universal plates and sheets do	548	628	West Germany 265; Belgium-Luxembourg 248.
Hoop and strip do	186	230	West Germany 132; Belgium-Luxembourg 69.
Rails and accessories do	43	39	West Germany 24; Belgium-Luxembourg 7; France 7.
Wire do	63	68	Belgium-Luxembourg 37; West Germany 27.
Tubes, pipes and fittings do	575	531	West Germany 317; France 92; Belgium-Luxembourg 37.
Castings and forgings do	5	6	West Germany 3; Belgium-Luxembourg 2.
Lead:			
Ore and concentrates	11	5	NA.
Oxides	9,164	10,269	Belgium-Luxembourg 5,135; West Germany 2,617; France 1,760.
Metals, including alloys:			
Scrap	1,864	4,536	West Germany 2,025; Belgium-Luxembourg 1,721.
Unwrought	55,650	54,412	Belgium-Luxembourg 18,518; Mexico 9,448; Australia 7,115.
Semimanufactures	3,252	3,505	Belgium-Luxembourg 2,314.
Magnesium, metal including alloys:			
Scrap	88	117	Norway 99.
Unwrought	294	274	U.S.S.R. 165; Norway 83.
Semimanufactures	49	56	West Germany 15; Austria 15; Switzerland 10.

See footnotes at end of table.

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Table 3.—Netherlands: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS—Continued			
Manganese:			
Ore and concentrates	42,771	36,135	U.S.S.R. 10,727; Morocco 8,418; Ghana 3,471.
Oxide	603	1,106	France 390; Japan 300; Belgium-Luxembourg 291.
Mercury, 76-pound flasks	1,334	1,305	Italy 348; Spain 290; United Kingdom 232; United States 232.
Molybdenum, including alloys, all forms	8	15	Austria 6; United Kingdom 2; West Germany 2.
Nickel:			
Matte, speiss and similar materials	258	182	All from United Kingdom.
Metal, including alloys:			
Scrap	1,351	1,391	United Kingdom 318; West Germany 281; France 208.
Unwrought	1,571	1,933	U.S.S.R. 608; Norway 503; United Kingdom 502.
Semimanufactures	2,216	3,223	West Germany 1,376; United Kingdom 738; France 387.
Platinum-group metals, thousand troy ounces	60	70	France 20; West Germany 18; U.S.S.R. 16.
Silver, including alloys:			
Unwrought, do.	1,659	3,545	United States 952; Belgium-Luxembourg 952; France 406; West Germany 401.
Semimanufactures, do.	2,215	2,735	West Germany 1,031; France 858; United Kingdom 676.
Tellurium, elemental and arsenic	9	10	Belgium-Luxembourg 9.
Tin:			
Ore and concentrate, long tons	20,085	11,461	Indonesia 4,852; Chile 1,969; Congo (Kinshasa) 1,718.
Oxide, do.	96	68	Belgium-Luxembourg 31; West Germany 23; United Kingdom 13.
Metal, including alloys:			
Scrap and semimanufactures, do.	362	301	Belgium-Luxembourg 192; West Germany 79.
Unwrought, do.	6,039	4,405	Thailand 2,070; mainland China 764; Republic of South Africa 330.
Titanium, dioxide	2,531	4,253	West Germany 2,502; France 1,040; Italy 489.
Tungsten:			
Ore and concentrate	------	218	Portugal 177; United Kingdom 30.
Metal, including alloys, all forms	NA	28	West Germany 8; United States 6; United Kingdom 5.
Vanadium, ore and concentrate, including molybdenum	16,184	15,410	United States 13,177; Canada 926; Australia 704.
Zinc:			
Ore and concentrate	82,533	96,260	Canada 36,742; Finland 22,977; Sweden 13,463; West Germany 10,686.
Oxides	1,688	1,826	West Germany 985; Belgium-Luxembourg 445.
Metal, including alloys:			
Scrap	213	557	West Germany 445; Belgium-Luxembourg 71.
Unwrought	16,155	18,485	North Korea 8,948; Belgium-Luxembourg 2,350; West Germany 1,788.
Semimanufactures, including dust	4,183	4,961	Belgium-Luxembourg 3,659; West Germany 1,099.
Other:			
Ore and concentrate	3,705	2,350	Republic of South Africa 1,730; Chile 180; Peru 118.
Ash and residues containing nonferrous metals:			
Lead	465	713	West Germany 502; Belgium-Luxembourg 206.
Tin, long tons	415	833	Belgium-Luxembourg 437; United States 138.
Zinc	32,188	33,975	West Germany 24,464; Denmark 1,781; Belgium-Luxembourg 1,663.
Other	44,124	43,456	Canada 41,542; U.S.S.R. 796.
Metals, including alloys, all forms:			
Metalloids:			
Selenium	18	4	United Kingdom 3; United States 1.
Silicon [3]	200	463	Sweden 160; West Germany 95; Italy 70.
Alkali, alkaline-earth and rare-earth metals	176	200	West Germany 174.
Oxides of barium, strontium, and magnesium	455	587	United States 163; United Kingdom 111; West Germany 111.

See footnotes at end of table.

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Table 3.—Netherlands: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS			
Abrasives, natural, n.e.s:			
Pumice, emery, natural corundum, etc.—thousand tons	371	371	West Germany 364; Italy 7.
Dust and powder of precious and semiprecious stones—thousand carats	765	1,417	Ireland 1,235.
Grinding and polishing stones	1,460	1,706	West Germany 901; Austria 243.
Asbestos	18,088	23,307	Canada 15,037; Italy 3,415.
Barite and witherite	21,151	30,075	West Germany 25,833; Ireland 1,493.
Boron materials:			
Crude natural borates	230,597	281,428	United States 272,203.
Oxide and acid	1,414	1,321	France 655; United States 602.
Cement—thousand tons	2,169	2,263	Belgium-Luxembourg 1,118; West Germany 1,100.
Chalk	114,656	137,192	Belgium-Luxembourg 87,781; France 39,087.
Clays and clay products:			
Crude clays:			
Kaolin—thousand tons	134	153	United Kingdom 122; Czechoslovakia 9.
Refractory—do	89	111	West Germany 84; United Kingdom 8.
Other—do	470	499	West Germany 451; United Kingdom 18.
Products:			
Refractory, including nonclay bricks—do	42	51	United Kingdom 21; West Germany 14.
Nonrefractory—do	161	174	West Germany 97; Belgium-Luxembourg 52.
Cryolite and chiolite	792	1,034	All from Denmark.
Diamond, all grades:			
Gem, not set or strung—thousand carats	1,647	1,276	NA.
Industrial—thousand kilograms	46	293	Brazil 268; U.S.S.R. 8.
Diatomite and other infusorial earths	7,501	8,041	Denmark 3,890; United States 1,724; West Germany 784.
Feldspar and leucite	26,531	32,056	West Germany 10,264; Norway 7,805; Canada 5,964.
Fertilizer materials:			
Crude:			
Phosphate rock—thousand tons	849	1,243	Morocco 510; Togo 363; Senegal 158.
Potassium salts—do	58	54	France 29; West Germany 25.
Sodium nitrate—do	55	4	All from Chile.
Manufactured:			
Nitrogenous—do	8	8	West Germany 4; Belgium-Luxembourg 3.
Phosphatic:			
Thomas slag (P_2O_5 content)—do	167	23	Belgium-Luxembourg 20; West Germany 3.
Other (P_2O_5 content)—do	113	30	United States 27; France 1.
Potassic—do	421	431	West Germany 170; Belgium-Luxembourg 64; East Germany 54.
Other, including mixed	66	34	Belgium-Luxembourg 15; West Germany 7.
Ammonia, anhydrous	2,079	50,025	United States 31,297; Aruba 11,123.
Fluorspar	19,870	22,607	Mainland China 7,819; United Kingdom 5,079; Spain 3,673.
Graphite, natural	185	239	West Germany 120; United Kingdom 49.
Gypsum and plasters—thousand tons	229	250	West Germany 173; France 60.
Lime—do	684	727	West Germany 362; Belgium-Luxembourg 345.
Magnesite	22,347	33,449	Greece 13,310; Austria 8,446; India 3,701.
Mica:			
Crude, including splittings and waste	937	1,688	United Kingdom 666; France 441; Norway 314.
Worked, including agglomerated splittings	54	59	Switzerland 29.
Pigments, mineral:			
Natural, crude	1,897	2,809	West Germany 1,874; Austria 427; France 345.
Iron oxides, processed	10,190	10,428	West Germany 6,601; France 1,788; Spain 1,239.
Pyrite—thousand tons	90	123	Cyprus 103; Portugal 13.
Salt	39,568	54,279	West Germany 41,340; France 12,798.
Sodium and potassium compounds, n.e.s:			
Caustic soda	58,835	49,665	West Germany 34,628; Italy 7,549; Belgium-Luxembourg 5,259.
Caustic potash	4,035	3,721	France 1,774; Belgium-Luxembourg 1,162; West Germany 407.

See footnotes at end of table.

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Table 3.—Netherlands: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS—Continued			
Stone, sand and gravel:			
Dimension stone:			
Slate	25,871	30,210	West Germany 12,565; France 8,700; Norway 7,210.
Other thousand tons	1,698	2,342	Belgium-Luxembourg 1,531; West Germany 598.
Dolomite do	387	435	Belgium-Luxembourg 406; West Germany 17.
Gravel and crushed rock do	10,236	13,510	West Germany 7,969; Belgium-Luxembourg 2,449; France 852.
Limestone do	766	919	Belgium-Luxembourg 885; United Kingdom 21.
Quartz and quartzite	44,936	54,814	Belgium-Luxembourg 28,239; West Germany 12,936; Norway 11,343.
Sand, excluding metal-bearing thousand tons	5,113	6,456	West Germany 5,887; Belgium-Luxembourg 477.
Sulfur:			
Elemental do	282	335	United States 261; France 67.
Sulfur dioxide	847	2,481	West Germany 2,465.
Sulfuric acid, oleum	24,435	31,526	West Germany 22,267; Belgium-Luxembourg 9,244.
Slag dross and similar waste, not metal bearing:			
From iron and steel manufacture thousand tons	2,175	3,157	West Germany 1,801; Belgium-Luxembourg 1,338.
Slag and ash, n.e.s. do	411	499	Belgium-Luxembourg 266; West Germany 233.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,486	1,967	West Germany 1,005; United States 408; Trinidad 407.
Carbon black (including other black carbon)	7,402	12,682	West Germany 8,131; Italy 2,020; United States 1,066.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	7,039	7,412	United Kingdom 631; Belgium-Luxembourg 357; Poland 253.
Briquets of anthracite and bituminous coal do	25	19	West Germany 17.
Lignite and lignite briquets do	176	144	All from West Germany.
Coke and semicoke do	188	397	West Germany 361; Belgium-Luxembourg 22.
Gas, hydrocarbon: Natural, including liquefied petroleum gas do	123	117	West Germany 99; Belgium-Luxembourg 15.
Peat do	113	93	All from West Germany.
Petroleum:[4]			
Crude do	31,871	35,796	Kuwait 10,760; Libya 8,052; Saudi Arabia 5,063; Iran 3,672.
Refinery products:			
Gasoline do	1,038	904	Belgium-Luxembourg 221; Netherlands Antilles 156; West Germany 138; France 110.
Kerosine, including jet fuel do	454	603	Belgium-Luxembourg 227; Italy 122; Bahrain 56.
Distillate fuel oils do	1,854	1,892	United Kingdom 550; Italy 320; Belgium-Luxembourg 176; Bahrain 173.
Residual fuel oils do	4,116	2,448	West Germany 1,271; Belgium-Luxembourg 259.
Lubricants do	320	372	Netherlands Antilles 188; United States 45; Belgium-Luxembourg 39.
Mineral jelly and wax do	20	19	West Germany 7; France 4; United States 4.
Other:			
Petroleum coke	119	127	United States 65; West Germany 52; Norway 10.
Bituminous mixtures, n.e.s. thousand tons	290	390	Belgium-Luxembourg 189; United States 130; West Germany 68.
Mineral tar and coal, petroleum, or gas derived crude chemicals do	268	247	West Germany 68; Belgium-Luxembourg 49; United States 38.

r Revised. NA Not available.
[1] Excluding gold coin and gold and alloys shipped by post.
[2] Including sponge iron, shot, grit, pellets; spiegeleisen and ferromanganese.
[3] At least 99.99 percent pure.
[4] Includes bunkers for Netherlands ships and aircraft; excludes deliveries to bonded storage.

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COMMODITY REVIEW

METALS

Aluminum.—The capacity of the aluminum smelter of ALDEL was expanded in 1969 to 90,000 tons per year. Further expansion of plant capacity has been planned for subsequent years.

In 1969 construction started on Péchiney's $140 million aluminum smelter in Flushing on Walcheren Island on the Schelde river. Two potlines, each with a capacity of 75,000 tons per year and employing 800 people, are to start in 1973. The Government plans to build a 400-megawatt powerplant in the area to supply the smelter. After 1975 the smelter capacity will be doubled.

An aluminum extrusion plant will be constructed in Roermond in the southern part of the Netherlands near Belgium and West Germany by Amax Aluminium Extruders N.V., a subsidiary of American Metal Climax Inc. The plant is scheduled to begin operations in mid-1970, with a capacity of 4,500 tons of extrusions per year and with anodizing capabilities.[2]

Iron and Steel.—The upward trend in the output of the iron and steel industry continued in 1969, as virtually all sectors registered gains compared with the 1968 output. About 73 percent of total crude steel output was produced by the oxygen process. The value of iron and steel product exports rose 16 percent in 1969, while the value of imports increased almost 8 percent. Apparent consumption of crude steel was 17 percent higher in 1969 than in 1968.

Work was continued on Hoogovens $280 million expansion program (See Minerals Yearbook 1968, The Mineral Industry of the Netherlands, Iron and Steel).

It was also learned that Hoogovens has stopped producing and selling foundry pig iron. The reason given was that blast furnaces of 4,000-ton-per-day capacity are not flexible enough to follow required variations in analysis of pig iron. Capacity saved will be used to provide additional pig iron for the company's steelmaking plants.

Tin.—Production comes from the Arnhem plant owned by Billiton, which has a capacity of 15,000 to 20,000 metric tons per year depending on the type of ore treated. The plant was operating well below capacity on a wide variety of ores.

Zinc.—The KZO and the Billiton concern jointly have started to build an electrolytic zinc plant at Budel. The participation of Billiton in the venture, which is called Kempensche Zincmatschappij, is 50 percent. The 100,000-ton-per-year electrolytic zinc plant will cost $28 million and will employ about 300 people.

The electrical power required will be generated by using natural gas, and the Government will subsidize the project.

NONMETALS

Fertilizer Materials.—The Royal Dutch/Shell Group Companies have decided to drill for evaporite minerals (potash and magnesium salts) in northern Holland. An exploration subsidiary, Shell, Delftstoffen N.V.[3] has been formed to carry out the exploration program, with drilling to start near Uithuizermeeden in 1970. Shell has obtained Government permission to drill in Friesland, Groningen, Drente, Waldenzee, and the Ems estuary zone.[4]

In September 1969 a new phosphoric acid terminal was commissioned in the Botlek area of Rotterdam by Fertilizantes Fosfatados Mexicanos S.A. (FFM). The new terminal has rubber-lined tanks capable of holding 27,000 tons of acid. It serves as FFM's distribution point for northwest Europe. Phosphoric acid from the FFM plant at Coatzacoalcos, Mexico was transported to Rotterdam on the 23,500-deadweight-ton tanker M/V FFM-Vassijaure, which was converted for this purpose. It was the first time a tanker carried such a large shipment of phosphoric acid across the Atlantic.

The Farbwerke Hoechst A.G. of West Germany, which is Europe's largest producer of phosphorus, has announced plans to construct a third 60-megawatt furnace at the Hoechst Vlissingen N.V. plant at Flushing, while the second furnace is under construction. Each furnace will have a capacity of 30,000 tons per year. The

[2] Skillings Mining Review. V. 58, No. 37, Sept. 13, 1968, p. 4.

[3] Engineering and Mining Journal. V. 170, No. 11, November 1969, p. 166.

[4] De Volkskrant (Periodical). Netherlands, Apr. 2, 1970.

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phosphorus is converted at Flushing into phosphoric acid and sodium-tripoly-phosphate, although increasing quantities will be exported when the second furnace is commissioned in 1970.

ENCK has announced a plan to use the hemihydrate process for a 60,000-ton-per-year phosphoric acid plant at Vlaardingen, to be commissioned in 1970. ENCK's present phosphoric acid capacity is 100,000 tons per year of P_2O_5. The contractor for the plant is the Lurgi Gesellschaft für Chemie und Hüttwesen m.b.h., Frankfurt, West Germany.

In May 1969 ESSO Chemie N.V. inaugurated its new fertilizer complex at Rotterdam. Capacity is 456,000 tons of ammonia per year, 230,000 tons of nitric acid, 35,000 tons of ammonium-calcium nitrate, and 180,000 tons of urea. Investment was about $70 million. The plant used domestic natural gas as a new raw material and also as a fuel.[5]

Sand and Gravel.—About 95 percent of the Netherlands gravel is extracted from the valley of the River Maas, between Maastricht and Roermond. The Maas-based gravel operations have a cooperative marketing organization. One of the main companies involved is N.V. Ballast Maatschappij "De Merverde". Its latest dredge, the Merverde 28 has a dredging capacity of 400 to 600 tons per hour and complete processing capability for sand and gravel.

MINERAL FUELS

All sectors of the mineral fuels industries again showed considerable change in 1969, as natural gas continued to provide the bulk of rising energy needs and made added inroads into coal markets, while petroleum products output also increased substantially. Notable developments of the year included a 50-percent increase in natural gas production; construction of additional crude and product pipelines, including expansion of major port areas; and a further shutdown of indigenous coal-producing capacity.

Coal.—The downward trend in coal and coke output persisted in 1969, as more productive capacity was shut down or curtailed in an effort to bring levels of domestic production more in line with dwindling demand.

Reductions in coal production stem from Government policy placing increased reliance on natural gas and petroleum products to meet rising energy requirements, with nuclear power to play an increasingly important role as new plants are constructed and become operative.

All Netherland coal mines will be closed by the end of 1975. The Willem Sophia mine at Speckholzerheide was scheduled to close in September 1970, the Dominiale mine at Kerkrade was also scheduled for 1970 and the Emma State mine at Hoensbroeck will be closed in September 1973.

The programmed closing of the Limburg coal mines makes it necessary to find new employment for the displaced miners. The Manpower Office of the Ministry for Social Affairs and Public Health operates three training centers for adults in Limburg and a training center at the State Mine School in Heerlen. The Government also provides subsidies to private industry for retraining miners according to Government-approved training programs. There were 550 training programs involving 100 companies and 5,700 coal miners in 1969.

Anthracite and bituminous coal imports into the Netherlands fell in 1969, to 6.5 million tons from 7.4 million tons imported in 1968. Coal exports from the Netherlands were slightly down to nearly 2 million tons.

Petroleum and Natural Gas.—Most oil and gas exploration and production activities in the Netherlands were carried out by Nederlandse Aardolie Maatschappij (NAM) in which Shell and Esso have a 50-percent interest.

NAM holds concessions in the western provinces (which have oilfields and gasfields) and also holds a number of concessions in the eastern part of the country, including the oilfield in the south of the province of Drenthe and also the major gasfield of Groningen. Other concessions had been granted to Amoco Netherlands Petroleum Co. and Petroland N.V. in the west and to Petroland N.V. group owned jointly by subsidiaries of Texaco Inc. and Standard Oil Company of California and NAM-Mobil producing Netherlands Inc. in the north of the Netherlands. Till the end of 1969, oil and natural gas were produced only on the concessions held by NAM.

Of the 1969 crude oil production, roughly one-third came from fields in the east of the Netherlands, the rest came

[5] Bulletin de l'industrie Pétroliere (BIP). No. 134, May 5, 1969, p. 7.

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from the western part of the country. This crude oil is transported by tank car, lighter, and pipeline to the Shell and Esso refineries near Rotterdam, which share the crude oil in processing.

Netherland's petroleum industry which is based principally on imported crude, continued to expand in 1969.

In July 1969 construction was completed on a project intended to more than double the capacity of the former Caltex refinery in Pernis near Rotterdam. The refinery is owned 68.4 percent by Chevron, with the balance held by Texaco. It is operated by Chevron. Extensions have boosted capacity to 12.5 million tons per year from the previous 5 million tons per year. Arabian and Libyan crude oil for the refinery will be brought to Europoort by tankers of up to 240,000 deadweight tons.

Shell Nederland started in October its fifth crude distillation unit at Pernis. This new plant, capable of processing 7.5 million tons of crude annually, increases the capacity of the complex to 25 million tons per year, making it the largest such plant in the world. In 1969 it processed 20 million tons of crude. Netherlands export of natural gas is in the hands of NAM (Gas Export) in The Hague. This division has so far concluded contracts in Belgium, West Germany, and France for gas deliveries to reach 800 billion cubic feet per year by 1975. Exports in 1969 were about 260 billion cubic feet.

In the Netherlands itself, distribution of natural gas is in the hands of N.V. Nederlandse Gasunie (NVNG), in which the Netherlands Government, the Netherland State Mines, Esso, and Shell hold 10, 40, 25, and 25 percent, respectively.

NVNG has started the first phase of its Ommen compressor station project for handling increasing amounts of Groningen gas now being marketed. When the facility is completed by 1975, it will be rated at 250,000 horsepower. In addition to the Ommen, Ravenstein, Wieringermeer, and Oldeboorn booster stations four more new booster stations are to be built between 1970 and 1980, the first at Angerlo.

Developments in the long-standing jurisdictional dispute concerning the delineation of the North Sea Continental Shelf boundaries between the Netherlands, West Germany, and Denmark has brought operations in the Dutch part of the disputed area almost to a halt. The Government has been holding up concessions for unassigned blocks until a settlement is reached. German, Dutch, and Danish delegations have been negotiating for a settlement, but the issue had not been settled by yearend.

A definitive agreement was reached on construction of a 26-inch pipeline with an annual capacity of about 34 million tons of crude oil between Rotterdam Europoort and Antwerp because the port of Antwerp is not accessible to supertankers. Participants in the Rottendam-Antwerpen Pijpleiding N.V. (Rotterdam-Antwerp Pipeline Corp., RAP) are Esso, British petroleum Petrofina, and Chevron.

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The Mineral Industry of New Zealand

By John A. Stock [1]

In 1969, the value of New Zealand's mineral production totaled $53.25 million,[2] an increase from the previous year. As usual, nonmetallics—sand, rock, and gravel, agricultural limestone, and kaolin—made up the bulk of mineral output value. The contribution of the fuels sector to the total value declined slightly. Metallics retained their customary last place, but initial production of lead-copper and zinc concentrates accounted for metallics displaying the greatest percentage increase of the three commodity categories. Value of total mineral production by year is shown in the following tabulation:

Year	Percent			Total value, million dollars [1]
	Metals	Non-metals	Fuels	
1960	2.2	55.2	42.6	55.33
1965	.7	66.4	32.9	65.78
1966	.5	68.0	31.5	69.52
1967	1.0	67.7	31.3	58.89
1968	.8	67.6	31.6	50.99
1969	1.7	67.8	30.5	53.25

[1] Exclusive of cement, manufactured fertilizers, and products of the New Zealand Refining Co. Ltd. at Marsden Point, Whangarei. Values for 1968 and 1969 converted from New Zealand currency devalued November 1967.

In the past few years, New Zealand has been striving to diversify its economy, and is now involved in an industrialization program exemplified by a basic steel industry and a projected aluminum smelter. More attention is being put on mining, with the prospect that the mining industry may become an important sector of New Zealand's economy. Early interests were associated with the potential for utilization of ironsands for a steel industry, the titanium bearing sands on the South Island, production of concentrates of lead, copper, and zinc, and the development of the Kapuni gasfield as a commercial venture. Recently, interest has been stimulated by the discovery of a large offshore oil or gas structure and by reworking abandoned gold and silver operations.

The New Zealand National Development Conference (NDC) was held in May 1969 and received the report of the Minerals Steering Committee (MC) on its study of natural resources, manpower requirements, and efficiency of the country's mineral industry. The committee estimated that the output of minerals would increase to $200 to $300 million annually by mid-1979 and require 12,000 persons. The NDC wants to exploit mineral resources with potential for saving or earning overseas funds. The NDC recommended that tariffs replace import licensing to protect industry, but some felt that import licensing and other measures may be necessary. In conjunction with NDC objectives, the New Zealand Geological Survey compiled a list of actual and potential mineral resources [3] which was published in early 1970.

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[1] Mining engineer, Bureau of Mines, Washington, D.C.

[2] Unless otherwise indicated, values herein are in U.S. dollars converted from New Zealand dollars at the rate of NZ$1 = US$1.12.

[3] New Zealand Geological Survey. Minerals of New Zealand. Reports 38A (Metallics) and 38B (Nonmetallics), February 1970.

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PRODUCTION

Available data for New Zealand's mineral production are listed in table 1.

Table 1.—New Zealand: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Copper ore, gross weight	152	51	71
Gold, troy ounces	10,703	8,626	10,717
Iron ore, gross weight	2,616	3,339	1,186
Lead-copper, concentrate	-----	-----	1,910
Silver, troy ounces	-----	3,854	e 6,830
Tungsten ore, gross weight	16	19	8
Zinc, concentrate	-----	-----	2,930
NONMETALS			
Cement, hydraulic	813,856	e 764,000	802,680
Clays:			
Bentonite	3,102	3,163	5,720
Fire clay	286,406	258,759	260,376
Kaolin (including china clay)	7,784	4,729	10,048
Diatomite	1,431	2,066	2,163
Dolomite	8,443	8,246	10,076
Fertilizer materials, manufactured, phosphatic, thousand tons	1,593	1,776	NA
Kauri gum	25	e 26	e 37
Magnesite	577	805	-----
Perlite	1,072	1,870	-----
Pumice	16,403	16,577	19,306
Quartz, glass sand	80,412	84,008	107,485
Salt	56,086	56,000	49,297
Serpentine, thousand tons	90	88	78
Stone:			
Dimension stone	35,148	25,453	22,454
Limestone:			
Agricultural and industrial, thousand tons	1,040	980	1,140
For cement, do	1,519	1,425	1,494
Sand, rock, and gravel, do	24,196	25,810	25,412
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite, thousand tons	(1)	(1)	-----
Bituminous, do	594	581	488
Subbituminous, do	1,643	1,507	1,705
Lignite, do	169	172	171
Coke, all types, do	61	e 61	53
Fuel briquets, all grades, do	20	18	-----
Gas, natural, gross production, million cubic feet	4	3	2
Petroleum:			
Crude, thousand 42-gallon barrels	3	2	3
Refinery products: [2]			
Gasoline, do	8,818	e 9,825	9,472
Distillate fuel oil, do	7,377	8,531	8,652
Residual fuel oil, do	836	832	719
Other, do	590	579	654
Refinery fuel and loss, do	1,882	1,880	2,059
Total, do	19,503	21,647	21,556

e Estimate. p Preliminary. NA Not available.
[1] Less than ½ unit.
[2] Estimates based on latest available data.

TRADE

During 1967–68, New Zealand's exports of mineral commodities increased NZ$1.3 million, and imports decreased NZ$12.6 million compared with those of 1966–67. Copper and petroleum products accounted for most of the increase in value of exports, whereas most commodities, except crude and partly refined petroleum and gasoline, contributed to the reduction of imports.

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Table 2.—New Zealand: Exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1966–67	1967–68
METALS		
Aluminum and alloys:		
Scrap	576	555
Unwrought and semimanufactures	342	415
Copper:		
Ore and concentrate	-----	107
Metal and alloys:		
Scrap	1,561	1,194
Unwrought and semimanufactures	2,907	3,907
Gold, refined [2] value	$98,742	$63,862
Iron and steel:		
Scrap	5,535	5,621
Unwrought and semimanufactures	558	1,372
Lead:		
Ore and concentrate	-----	780
Metal and alloys:		
Scrap	986	1,030
Unwrought and semimanufactures	250	640
Nickel, metal and alloys, scrap	r 13	8
Silver and platinum ores [2] value	$74,005	$72,225
Tin and alloys:		
Scrap long tons	2	6
Unwrought and semimanufactures do	22	5
Zinc:		
Ore and concentrate	-----	1,155
Metal and alloys:		
Scrap and ash	215	160
Unwrought and semimanufactures	17	25
Other:		
Ore and concentrate of base metals, n.e.s	r 9	15
Ash and residue containing nonferrous metals [2] value	$322,293	$253,317
NONMETALS		
Asbestos articles and building materials [2] value	$170,753	$101,269
Cement	1	951
Clay and refractory building materials [2] value	$47,639	$75,864
Fertilizer materials:		
Crude	561	1,059
Manufactured	657	752
Kauri gum	21	22
Pumice	746	649
Stone, sand and gravel	158	284
Stone, monumental [2] value	$7,873	$10,125
Other minerals	114	256
MINERAL FUELS AND RELATED MATERIALS		
Coal and briquets	8	8
Coke	18	29
Petroleum products [2] value, thousands	$6,384	$5,957

r Revised.
[1] Fiscal period, July 1 through June 30.
[2] Converted from NZ$ at NZ$1 = US$1.3905 for 1966–67, and at a prorated value of US$1.2327 for 1967–68.

Table 3.—New Zealand: Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1966–67	1967–68
METALS		
Aluminum:		
Oxides and hydroxides	504	688
Metals and alloys:		
Unwrought	10,069	6,899
Semimanufactures	5,712	4,445
Antimony, metal [2] value	$89,039	$21,368
Arsenic, oxides and acids	162	143
Chromium, oxides and hydroxides	131	88
Copper, metal, including alloys:		
Unwrought	244	168
Semimanufactures	12,958	10,633
Gold, metal, unworked troy ounces	13,171	7,317
Iron and steel:		
Pig iron, ferroalloys and similar materials	8,916	7,215
Steel, primary forms	69	54
Semimanufactures	479,421	361,312

See footnotes at end of table.

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Table 3.—New Zealand: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity		1966–67	1967–68
METALS—Continued			
Lead:			
Oxides		882	280
Metal, including alloys:			
Unwrought		5,706	4,461
Semimanufactures		23	19
Magnesium, metal, unwrought		2	7
Manganese, oxides		497	396
Mercury	76-pound flasks	143	107
Nickel, metal, including alloys:			
Unwrought		47	25
Semimanufactures		374	187
Silver, metal, including alloys	thousand troy ounces	1,630	1,228
Tin:			
Oxides	long tons	11	8
Metal, including alloys:			
Unwrought	do.	389	293
Semimanufactures	do.	20	14
Titanium, oxides		664	575
Zinc:			
Oxide		18	18
Metal, including alloys:			
Unwrought		4,047	3,635
Semimanufactures		800	558
NONMETALS			
Asbestos		8,078	5,946
Barite		2,303	873
Cement		2,878	2,927
Chalk		1,216	1,048
Clays and clay products: Kaolin and refractory clays, crude		6,318	4,873
Diatomite and other infusorial earths		832	884
Feldspar, fluorspar, and nepheline syenite		1,683	1,406
Fertilizer materials:			
Crude:			
Nitrogenous		2,642	747
Phosphatic	thousand tons	1,068	886
Manufactured:			
Phosphatic, including basic slag		24,446	22,115
Potassic		158,472	120,487
Graphite, natural		210	131
Gypsum and plasters		112,700	89,021
Lime		292	303
Magnesite		272	342
Pigments, mineral, including processed iron oxides		r 814	643
Salt (excluding brines)		44,452	45,769
Stone, sand and gravel:			
Building, dimension stone, and slate		1,004	816
Sand, gravel and crushed stone		419	446
Quartz and quartzite		1,864	1,249
Sulfur, elemental, all forms		190,637	169,097
Talc and steatite		1,415	1,429
MINERAL FUELS AND RELATED MATERIALS			
Bitumen, natural		358	213
Carbon black		4,132	3,889
Coal		39,238	5,101
Coke and briquets		61	51
Gas, hydrocarbon [2]	value	$115,754	$94,003
Petroleum:			
Crude	thousand tons	1,553	1,544
Partly refined	thousand 42-gallon barrels	9,664	7,089
Refinery products:			
Gasoline	do.	2,111	2,036
Kerosine and jet fuel	do.	1,415	1,196
Distillate fuel oil	do.	1,208	903
Residual fuel oil	do.	36	-----
Lubricants [2]	value, thousands	$5,727	$5,064
Other [2]	do.	$2,204	$1,768
Mineral tar from coal, petroleum or gas	thousand 42-gallon barrels	30	21

r Revised.
[1] Fiscal period, July 1 through June 30.
[2] Converted from NZ$ at NZ$1 = US$1.3905 for 1966–67 and at a prorated value of US$1.2327 for 1967–68.

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Table 4.—New Zealand: Principal sources of selected mineral commodity imports, 1967–68

(Metric tons)

Commodity	Quantity
METALS	
Aluminum, unwrought and semimanufactures, total	11,344
Canada	8,160
United States	1,276
Australia	1,079
Copper, unwrought and semimanufactures, total	10,801
Australia	5,677
United Kingdom	3,394
Canada	1,631
Iron and steel:	
Primary forms and ferroalloys, total	7,269
Australia	5,915
Republic of South Africa	591
United Kingdom	392
Semimanufactures, total	361,312
Australia	202,492
United Kingdom	85,136
Japan	57,474
NONMETALS	
Fertilizers, crude and manufactured, all types, total	1,029,849
Nauru	472,967
United States	198,109
Australia	148,678
Sulfur, elemental, total	169,097
Canada	77,401
Mexico	52,360
United States	38,972
MINERAL FUELS AND RELATED MATERIALS	
Petroleum, crude and partly refined, total	2,489,505
Kuwait	1,357,139
Iran	649,457
Saudi Arabia	269,573

COMMODITY REVIEW

METALS

Aluminum.—Planning and preliminary construction of the aluminum smelter-powerplant scheme on South Island has continued in the face of opposition from conservationists. They feel that raising the level of Lake Manapouri to secure additional head for the hydroelectric plant will impair the natural beauty of the area. To counter this, the Government plans to preserve esthetic values by clearing 200 miles of shoreline; the $6 million cost of this project will be assumed by the smelter being built at Bluff in terms of higher power costs.

In late 1969, a contract for the design of the $101 million Bluff smelter was awarded to the Kaiser Aluminium & Chemical Corp., Engineering Division of California. Construction is to be in the hands of the New Zealand Construction Co. of Invercargill. Engineering was begun and construction on the site was to follow almost immediately.

The smelter will be the largest industry on South Island and is jointly owned by the Commonwealth Aluminium Corp. Pty. Ltd. (Comalco), the Sumitomo Chemical Co. Ltd., and Showa Denko KK. The operating company will be called New Zealand Aluminium Smelters Ltd. Initially, 75,000 metric tons of aluminum is expected by mid-1971, and full design output of 107,000 tons may be reached before December 1972, as scheduled. Comalco, owned equally by the Kaiser Aluminum & Chemical Corp. of the United States and Conzinc Riotinto of Australia Ltd., is preparing to market its half of production, from the smelter, in New Zealand and Southeast Asia. The two Japanese companies each plan to export its share to Japan. Comalco's marketing plans include venturing into semimanufacturing, a field currently dominated in the country by Alcan New Zealand Ltd.

Copper.—Conzinc Riotinto Australia Exploration Pty. Ltd. (CRA) has given up prospecting titles to Whatapuke Island as it had previously for Coppermine Island. Mineralization on both these islands was felt to be inadequate to support an economic copper mining venture.

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On South Island, Kennecott Exploration (Australia) Pty. Ltd. has been prospecting for copper and other metals in the Lake McKerrow and the Eglington Valley-Lake Gunn regions of western Otago. New Zealand Mineral Development Ltd. has been working to confirm earlier prospecting estimates of the existence of 50,000 tons of good quality copper ore in the Moke Creek area, South Island.

Gold and Silver.—Two new companies, Waihi Exploration and Mining Ltd. and Southern Cross Minerals Exploration Ltd., were active near Waihi and Paeroa, North Island. After geophysical study, Waihi Exploration planned to investigate, by diamond drilling, the possibility of the continuation of gold-silver lodes beyond a fault zone cutoff (which led to the closing of the rich Martha Mine some years ago). Southern Cross proposed to reopen the Maria Lode in the old Talisman Mine at Karangahake and, if feasible, will mine sections and treat samples in a pilot plant to determine the content of gold, silver, and base metals.

On South Island, after prior seismic work, the Marine Mining Corp. of New Jersey continued prospecting for gold by borings on a 150-mile stretch of beach from the Teremakau River southward to the Waiho River, and may extend operations offshore from a drilling rig. The London Tin Corp. Ltd., Helpet Mining Pty. Ltd. of Sydney, and Kaiser were planning to prospect for gold and other metallic minerals in the Glenorchy-Rees River districts, the upper Shotover River and Macetown district, and 50 miles of beach from Birdlings Flat southwards to the Rangitata River, respectively. Helpet has already started test drilling in the Macraes Flat district for gold and scheelite. The Nickel Spoon Mining Co. Ltd. reported good assays of gold, nickel, and chromium in samples taken during prospecting in the Gorge River district, South Westland. In late 1969, the Lamerand Holdings Syndicate was considering the possibility of reopening the old Blackwater Gold Mine at Waiuta, which had closed down in 1951.

Ironsands.—In early 1969, millions of tons of high-grade ironsand were discovered on the South Taranaki coastline for Marcona Development NZ Ltd. by Adaras Developments Ltd. This North Island beach deposit, about 35 kilometers northward from Whanganui, was investigated by drilling during the year. Seven Japanese steel firms have shown interest in New Zealand ironsands, and both Marcona (a subsidiary of Marcona Corp. of the United States) and New Zealand Steel Ltd. (NZS) have offered to export 1 million tons of concentrate per year to Japan over a 10-year period starting in 1971. The Japanese are interested in the ironsands because the titanium content of the ore, when blended in small amounts with other ores, tends to extend the life of the firebrick lining in blast furnaces. During 1969, Marcona produced concentrate at a pilot plant near Waverly and sent a trial shipment of 5,000 tons to Japan. NZS also was planning to send a similar trial shipment to Japan from their deposit near the north head of the Waikato River, but additional sales would probably originate from a new 300-million ton deposit at Taharoa.[4]

Iron and Steel.—During 1969, work stoppages at the Glenbrook Works of NZS at Waiuku, North Island, delayed the completion and increased the construction costs of the new steel mill. Originally, production of steel was scheduled to begin June 1969, but time lost in labor disputes and time required to prepare and test the various steelmaking stages has placed the startup date somewhere in early 1970. Following startup, billet production capacity is expected to increase to 130,000 tons by 1971 or 1972. Pacific Steel Ltd., (40 percent owned by NZS) will buy most of this production to supply the domestic market with rod, pipe, and bars. Pacific has recently installed a new wire rod mill. In addition to a delayed startup, new loans from overseas of $2 million have been required by the increased construction costs.

Since November 1968, the Glenbrook Works has operated a continuous galvanizing mill using imported cold-rolled coil. In June 1969 the mill attained its full capacity rate of 100,000 tons per year. This rate far exceeds current New Zealand demands. Through 1969, 51,000 tons of galvanized products were put out, part of which was exported to the Pacific Islands. In 1971 the output of galvanized products is expected to be more than 70,000 tons.

The Stelco-Lurgi direct reduction process, which NZS will use to produce steel from ironsands, consists of a concentrating

[4] Ridley, J. W. The Development of New Zealand Ironsands. Min. Magazine, v. 119, No. 1, July 1968, pp. 4–15.

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and pelletizing stage, a rotary kiln, two 16-foot-diameter electric furnaces, and a continuous-casting machine. All stages had been tested by the end of 1969, except the rotary kiln, which was still being dried in preparation for pellet production. When all equipment is finally commissioned, ironsands will be concentrated magnetically and formed into green pellets, using a small amount of bentonite, then the pellets (with the addition of subbituminous coal and limestone) will be reduced to sponge iron in the kiln. The hardened pellets (with 18 percent scrap steel) will be converted to steel in the furnaces, and the molten steel will be transferred to the casting machine to produce billets.

In spite of delays and additional costs NZS is optimistic and plans to advance the date of a pipe mill installation at a cost of $4 million. If schedules are met and additional items are produced, the total tonnage from the galvanizing mill, steel mill, and pipe mill, (geared to New Zealand consumption patterns) is expected to exceed 400,000 tons by 1978.

Lead and Zinc.—During 1969 Norpac Mines Ltd., the only base metal operation in New Zealand, produced and exported zinc and lead-copper concentrates from the Tui mine near Te Aroha. Shipments were made to Mitsui and Co. Ltd. in Japan.

Nickel.—George Parnell Ltd. was issued a license to prospect for nickel and associated minerals on land owned by the Auckland Harbor Board in the Waitakere ranges.

Titanium.—Ilmenite-bearing sands on the west coast of South Island have been undergoing tests during the year by Rutile and Zircon Mines (Newcastle) Ltd. (RZM) in anticipation of constructing a plant to produce synthetic rutile. RZM has been evaluating Westport ilmenite for the past 2 years, and if pilot-plant tests are satisfactory, a $13 million plant will be built near Westport starting at yearend 1970. Capacity of the plant will probably be 100,000 tons per year of upgraded ilmenite. Last year, RZM formed a subsidiary, Chlorination Technology Ltd., to carry out feasibility and process studies, and under an agreement with Lime and Marble Ltd. and Buller Minerals Ltd., RZM has an option to large reserves of ilmenite sands. Currently, plans are to produce synthetic rutile suitable for the chloride process for producing TiO_2 pigment.

NONMETALS

Bentonite.—Lime and Marble Ltd. of Mapua shipped 500 tons of dust-free bentonite pellets from its Coalgate plant to the Savage River iron mines in 1969. The latest estimate of bentonite reserves at Coalgate, South Island, is reportedly 20 million tons within a deposit 60 meters deep and 2.4 kilometers long. Present Australian imports of bentonite total 50,000 tons annually. The company anticipates a growing market for exporting bentonite to Australia after supplying NZS with about 10,000 tons per year for use in pelletizing ironsand concentrate.

Silica.—Vast quantities of high-grade silica (99 percent pure) were reportedly discovered near Invercargill, South Island, during 1969. Some speculations have been made that the find could provide a basis for a major electrometallurgical industry in conjunction with the Glenbrook steel plant and the nearby aluminum smelter being constructed at Bluff, South Island; however, the market for alloy steel is small in New Zealand and economic considerations may make these speculations unfeasible at the present.

Sulfur.—Interest in prospecting for native sulfur deposits aroused by the success of Cyminex Corp. (a New Zealand subsidiary of Cyanamid Australia Pty. Ltd.) in outlining 30 million tons of 20-percent sulfur ore has continued during the year. However, Cyminex has been the only company to obtain approval of any of its prospecting warrants. After a year of exploratory drilling by Cyanamid Australia Pty. Ltd. (a subsidiary of American Cyanamid Co. of the United States), 6 million tons of elemental sulfur was confirmed under a thermal lake at Rotokaua, near Taupo. Other New Zealand, Australian, and United States companies have made applications to search other areas in this central North Island thermal belt for volcanic sulfur, but these have been held up by complex mining and land laws. Land is either Maori, European, or Crown owned. Maori landowners have rights to minerals under their land but Europeans generally do not. In addition, applications to prospect must be approved by landowners, county councils, wildlife and catchment organizations, and the Lands Department before a per-

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mit can be signed by the Minister. As a result of these complications, some applications have been in process for a year and a half without signs of settlement.

Cyminex is still looking into methods for extracting the Rotokaua sulfur lying under more than 30 meters of pumice and hot lake water. Reportedly, the methods will either be dredging or open pit mining after the lake is drained. Volcanic pressure, acid water, and gases are being considered as possible hazards that may cause thermal eruption or corrosion problems. The Rotokaua deposit is sufficiently large to meet New Zealand and Australian requirements for sulfur for 10 years and would save imports of sulfur into New Zealand, which presently total about 200,000 tons annually. Among the companies waiting for prospecting applications are Mines Exploration Ltd. (a subsidiary of Broken Hill South Ltd.), Newbold Oil Co., Shaw River Alluvials, and Cyminex. Some international mining companies have made inquiries into land ownership in sulfur areas.

MINERAL FUELS

Petroleum and Natural Gas.—Activity in petroleum exploration has shifted emphasis to New Zealand from Australia because of two, offshore, oil confirmations in New Zealand, a number of dry holes in Australia, and a fear of pollution from offshore wells in Australia. Interest is high enough for Australia's Broken Hill Pty. Ltd. (BHP) and its subsidiary, Hematite Petroleum, to try to earn an interest in the license block to the north of the two confirmed wells. Although most interest is in offshore search, it is expected that onshore search will also receive more attention in New Zealand.

In mid-1969 Murphy Australia Oil Co. and Odeco New Zealand Inc. (both subsidiaries of United States companies) joined the consortium of Tasman Petroleum Ltd. and New Zealand Aquitaine Petroleum Ltd. to explore eight onshore and offshore license areas in the South Taranaki Basin area, which are held by Tasman. Shareholders in Tasman are Beach Petroleum NL, Broken Hill South Ltd., North Broken Hill Ltd., and Lime and Marble Ltd. of New Zealand. The consortium plans to drill its first well in early 1970.

Since the early 1969 oil discovery in their Maui 1 wildcat well, Shell Oil Co., British Petroleum (BP), and Todd Oil Services Ltd. made plans to outline and appraise the Maui structure. In late 1969 a semisubmersible drilling rig was imported from Canada and used to drill Maui 2 and struck condensate and gas at between 2,700 and 3,200 meters and bottomed at 3,500 meters. Maui 2 was drilled 9 miles closer to shore (westsouthwest of Opunake, North Island) than Maui 1. It is likely that the Maui field will not produce commercial quantities of oil, but seems certain to be a big gas structure. As a gas energy source, it has been estimated that the field could save New Zealand $30 million annually in foreign exchange.

Seismic surveys started last year on the continental shelf off Otago (from Dunedin to the West Cape, South Island) by Mississippi Oil NZ Exploration Co. were completed and information was processed in the United States. Tasman Petroleum Ltd., BP Oil Exploration (NZ) Ltd., and Hunt International Petroleum, near the end of 1969 showed an interest in oil search on Chatham's Rise by applying for prospecting rights. Chatham's Rise is below an ocean area 805 kilometers by 160 kilometers, extending from 80 kilometers east of Banks Peninsula, South Island, to 80 kilometers east of the Chatham Islands. Republic Mineral Corp. of Houston, Tex., planned an extensive drilling program in the North Island's Waikato basin between Hamilton and Auckland. Republic was forming a local company (50-percent New Zealand owned) to do the work.

Petroleum Services Ltd. completed a test well, Taradale 1, near Napier, North Island, for BP, Shell, Aquitaine, and Todd Petroleum Development at 1,607 meters and was evaluating the information from the well. Petroleum Services then moved to the site of Rakaiatai 1 well near Dannevirke and abandoned drilling at a shallow depth after entering bedrock.

New Zealand Petroleum Exploration Ltd. (NZP) planned to deepen Waimamaku 1 test well in the Wekaweka Valley southeast of Hokianga Harbor, North Island, from 1,270 meters to 2,740 meters. Further tests are to be made on the hydrocarbon bearing sands. Gas samples from NZP's Wairaraki 1 well in Wekaweka Valley is of high fuel quality, however, more tests are needed to determine economic quantities of the gas.

BP, Shell, Todd Exploration consortium planned to have New Zealand Exploration

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Co. Ltd. drill a first test well in the Selwyn River area, 32 kilometers southwest of Christchurch, Canterbury, possibly a second well in the Canterbury Plains, and a test well in the Waiau River Basin, Southland.

ANZPAC Petroleum Ltd. temporarily abandoned Whakamaro 1 test well at 920 meters located 10 kilometers west of Taumarunui, North Island, because only minor amounts of hydrocarbons were found. ANZPAC was preparing to drill another well in the Upper Retaruka Valley 32 kilometers south of Taumarunui.

Bounty Oil Ltd. of Australia planned to drill a 2,400-meter well near Blackwater 1 well, Murchison, South Island, where traces of gas and oil were found in 1968. Bounty also has contracted for seismic surveys in the Taranaki-Wanganui Basin, North Island, and in the Canterbury Basin of the South Island. Drilling will start as soon as a site is located. Bounty will earn a 50-percent interest in each of these areas from International Energy Co. and Hackathorn NZ Oil Ltd. after drilling.

Inland transportation of petroleum products presently is by road and rail tankers, but in mid-1969, tentative plans were made by major oil companies for a 200-mile pipeline to carry products from the New Zealand Oil refinery at Marsden Point, Whangarei, North Island, to Hamilton through Auckland. Exports of refinery products were about $7.2 million in 1969.

Egmont Oil Wells Ltd. at New Plymouth produced about 3,000 barrels of crude oil at a value of about $9,800.

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The Mineral Industry of Nigeria

By David A. Carleton [1]

On January 15, 1970, after nearly 3 years of conflict created by the secession of the Eastern Region (Republic of Biafra) from the Federal Military Government of Nigeria, the Nigerian war formally came to an end with the capitulation of secessionist Biafra. During this period of strife, economic development was restrained; however, conditions and plans for economic growth continued. Despite disruption in production and distribution, particularly in the war affected areas, and the slowdown in foreign capital inflows, the performance of the economy was not drastically impaired.

Even though the oil industry was mainly preoccupied during 1969 in preparing for a jump in oil production after the end of hostilities, petroleum production during the year actually exceeded previous annual records. The revival of oil exports allowed a substantial increase in those imports needed to meet the demands of the rising pace of activity in the mining and manufacturing sectors. In 1968 the mining and petroleum industry contributed 5 percent to the country's gross national production (GNP). Apart from the petroleum industry, there was little foreign investment in Nigeria's mineral industry during 1969.[2]

PRODUCTION

Mineral production in 1969 compared with that of 1968 is characterized by a substantial rise in crude oil production (nearly fourfold), a decline in tin and tantalite production, and a slight increase in other minerals.

[1] Supervisory foreign mineral specialist (petroleum), Bureau of Mines, Washington, D.C.

[2] Standard Bank, Ltd. Annual Economic Review—Nigeria. June 1970. 20 pp.

Table 1.—Nigeria: Production of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
METALS				
Columbite, concentrate		1,955	1,147	1,515
Gold	troy ounces	39	215	298
Lead:				
Concentrate, gross weight		•2,000	-------	-------
Lead content		•1,500	-------	-------
Monazite, concentrate		114	•6	18
Tantalite, concentrate	kilograms	19,304	11,400	6,056
Tin (cassiterite):				
Concentrate, gross weight	long tons	12,620	13,031	11,630
Tin content	do.	9,340	9,644	8,606
Metal, unwrought	do.	9,104	9,778	8,740
NONMETALS				
Cement	thousand tons	784	574	566
Clay, kaolin		325	237	469
Limestone	thousand tons	847	647	691
Marble		1,281	175	1,168
Salt		NA	NA	6
MINERAL FUELS AND RELATED MATERIALS				
Coal	thousand tons	95	•4	25
Gas, natural:				
Gross	million cubic feet	93,950	51,628	145,714
Marketed	do.	r6,406	5,190	2,252
Petroleum:				
Crude	thousand 42-gallon barrels	r116,519	51,907	197,204
Refinery products:				
Gasoline, motor	do.	1,219	-------	-------
Kerosine	do.	804	-------	-------
Distillate fuel oil	do.	1,314	-------	-------
Residual fuel oil	do.	1,484	-------	-------
Liquefied petroleum gas	do.	24	-------	-------
Total	do.	4,845	-------	-------

• Estimate. r Revised. NA Not available.

[1] Excludes mineral production of the Biafrans.

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TRADE

Total imports in 1969 were higher than in 1967 and 1968. This pattern is a reflection of the need to conserve foreign exchange required for the war effort as influenced by the changing level of petroleum imports. The fiscal dictates of the conflict gave rise to import restrictions, exchange controls, and an upturn in selective import and excise duties. The mining industry was hit hard by the increase in duties on key items such as petroleum products, lubricants, steel pipe, wire rope, and new machinery. With the war's end many of these restrictions will be relaxed.

In 1969 mineral export trade represented 70 percent of total exports compared with 25 percent in 1968, a result of increase in crude oil exports. With Port Harcourt refinery closed throughout 1969, the importation of refined petroleum products showed a further increase, emphasizing the savings to be made when the refinery comes back on stream, supposedly in mid-1970. Mineral imports in 1969, of which 44 percent were iron and steel products and 33 percent refined petroleum products, rose 24 percent during the year. The rise was mostly in cement and iron and steel products for construction purposes. In 1969 mineral commodities accounted for 19 percent of imports compared with only 14 percent in 1967.

Table 2.—Nigeria: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
METALS				
Columbite, ore and concentrate		2,118	1,371	1,331
Iron and steel:				
Scrap		6,763	7,528	20,497
Semimanufactures		20	56	7
Lead, ore and concentrate		923	52	[1]
Nickel		NA	NA	163
Tantalum		15	16	17
Tin:				
Ore and concentrate	long tons	9	1,151	4
Metal and unwrought alloys	do.	10,813	11,280	10,110
Zinc, ore and concentrate		10	81	43
Other nonferrous:				
Ores and concentrate [2]		r 3,645	772	1,110
Scrap		2,012	1,662	2,411
NONMETALS				
Construction materials		150	63	63
Fertilizer materials, natural		120	340	233
MINERAL FUELS AND RELATED MATERIALS				
Asphalt, natural		18	18	1,032
Coal, coke, and briquets		8	------	------
Petroleum, crude	thousand 42-gallon barrels	88,736	52,847	198,963
Petroleum refinery products:				
Aviation gasoline	do.	43	43	------
Motor gasoline	do.	72	100	1
Jet fuel	do.	28	56	------
Kerosine	do.	62	23	------
Distillate fuel oil	do.	139	147	------
Residual fuel oil	do.	340	10	21
Lubricants	do.	44	20	------
Asphalt	do.	24	42	------
Other	do.	36	7	------

r Revised. NA Not available.
[1] Insignificant.
[2] Includes copper, zirconium, and other ores and concentrates.

Source: Nigeria Trade Summary, Nigerian Federal Office of Statistics. December issues, 1967, 1968, and 1969.

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Table 3.—Nigeria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Aluminum, metal and alloys:			
Unwrought	133	47	138
Semimanufactures	1,850	2,927	4,553
Copper, metal and alloys:			
Unwrought	12	16	10
Semimanufactures	2,216	1,192	884
Iron and steel:			
Pig iron and ferroalloys	958	599	754
Unwrought	2,752	2,336	8,154
Semimanufactures	235,436	230,257	326,075
Lead, metal, unwrought and semimanufactures	464	371	908
Nickel, metal, unwrought and semimanufactures	44	16	12
Platinum-group metals, unworked troy ounces	22,848	2,112	2,975
Silver, unworked do.	7,263	1,368	13,186
Tin, metal and alloys long tons	187	90	458
Zinc, metal and alloys	2,540	1,728	6,372
Metals, n.e.s.:			
Metallic oxides, mainly for paint	430	524	850
Nonferrous metals:			
Ores and concentrates	114	16	519
Scrap	1,541	199	245
Base metals	18	3	380
NONMETALS			
Abrasives	183	44	125
Asbestos	9,864	15,277	20,358
Cement thousand tons	45	92	105
Clay construction materials do.	10	8,021	9,467
Fertilizer materials:			
Crude, all types	889	204	2,136
Manufactured:			
Nitrogenous	29,378	1,593	4,251
Phosphatic	28,845	24,348	26,512
Potassic	2,220	198	474
Mixed	5,364	1,722	11,980
Ammonia	490	272	453
Lime	9,501	5,720	7,713
Mica	9	13	146
Salt thousand tons	126	130	140
Sodium and potassium compounds including caustic soda	8,803	12,340	13,637
Stone:			
Dimension thousand tons	1	2	4
Crushed rock, sand, and gravel do.	35	13	25
Grinding stones and wheels	131	126	118
Sulfur, all forms	1,310	257	118
Nonmetallics, n.e.s	1,169	6,099	3,233
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural	64,470	49,194	79,864
Coal, coke, and briquets	76,717	2,308	5,014
Petroleum refinery products:			
Aviation gasoline thousand 42-gallon barrels	65	112	110
Motor gasoline do.	1,003	2,300	2,892
Kerosine do.	438	935	1,060
Jet fuel do.	155	537	781
Distillate fuel oil do.	967	2,473	2,428
Residual fuel oil do.	962	1,743	2,262
Lubricants do.	265	169	238
Asphalt do.	4	66	113
Other do.	r32	76	46

r Revised.

Source: Nigerian Trade Summary, Nigerian Federal Office of Statistics, December issues for 1967, 1968, and 1969.

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1967	246	680
1968	147	591
1969	424	895
Imports:		
1967	91	626
1968	105	541
1969	130	696

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COMMODITY REVIEW

METALS

Iron and Steel.—A team of Soviet geologists has been commissioned by the Nigerian Government to explore for iron ore deposits of better quality than those existing in the Ilorin area of Kwara State. These latter deposits have an iron content ranging from only 41 to 51 percent. A 1968 survey by the Soviets recommended the blending of these ores with high-grade imported ore and that this blend be fed to a simple blast furnace. Reportedly, the Soviets are also preparing technical studies which envision the establishment of a 500,000- to 600,000-ton-per-year iron and steel project by 1975. Such a plant would meet domestic requirements for iron and steel products as well as those for neighboring countries.[3] Because of the war one of the galvanized sheet metal plants in South-Eastern State was temporarily out of production. In addition, there are plans for a small rolling mill in the Lagos area to utilize scrap; it is envisaged also that an electric furnace may be added at a later date.

Tin.—Although the increase in world tin prices was most welcome to Nigerian producers in helping the industry meet increased costs, the producers found more problems in keeping up with quotas through a reduced labor supply and from difficulties in obtaining machinery and spare parts because of import licensing requirements. The tin stealing problem has again been paramount, a great deal of concern being expressed at the mines about the impact of this on the production and costs.

Although Nigeria was permitted under the International Tin Council control measures to export over 10,000 long tons in 1969, actual production of tin-in-concentrates was 8,606 long tons. In addition to an erratic and lengthy rainy season, problems imposed by the war included increased fuel costs, delays in transportation, and the imposition of import permits, which caused serious delay in ordering essential supplies.

NONMETALS

Cement.—Cement demand has been extremely high, and the two cement plants that remained in production during the crisis have been unable to meet requirements. The Ewekoro plant of West African Portland Cement Co., Ltd., in Western State has been working on a 24-hour basis and in spite of many problems has succeeded in maintaining production at nearly a 500-ton-per-year level, its maximum capacity. The owners are entering into a $7 million expansion program that aims to increase maximum capacity to 840,000 long tons per annum. The other plant in production, Sokoto, continued to be plagued with troubles and output fell below its 100,000-ton-per-year capacity. The Nkalagu plant, 30 miles east of Enugu, remained closed during the crisis, but the Government officials have this plant on a priority list to commence production as soon as possible; however, damage to the plant was extensive owing to a too quick shutdown of the plant in 1967. Several of the kilns are warped and one is cracked. The bagging plant was almost totally destroyed.

In the Mid-Western Region, the Ukpilla factory, which is capable of 150,000 tons per year, is expected to start up in 1970. This operation, which was about to go into production at the outbreak of hostilities, will be managed by an Indian technical firm, which received a contract in 1969. Rehabilitative work on the Calabar plant continued through 1969, and production of the 150,000-ton-per-year facility is expected by mid-1970.

The asbestos cement plant at Ikeja has experienced difficulty maintaining top production, whereas the Enugu asbestos cement unit was still closed at yearend 1969. Plans are well advanced to repair and reopen the latter plant before the end of 1970. Plans are being considered to build a similar plant at Kaduna in North Central State.

MINERAL FUELS

Coal.—Since its discovery near Enugu at the turn of the century, coal has played a significant role in the development of Nigeria's economy. Except for the Okaba deposits, which were opened and exploited by the New Nigerian Development Corp. (N.N.D.C.) during the war, only the

[3] Mining Journal. V. 272, No. 6984, June 27, 1969, p. 571.

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Enugu deposits have been exploited on a large scale. Of Nigeria's total coal reserves of 340 million tons, only 640,000 tons were produced in 1966 (latest year of uninterrupted production), a decline from a record high of about 900,000 tons in 1958.

Owing to the dieselization of railway locomotives, the conversion from coal-fired to oil-fired furnaces at powerplants, and construction of the large Kainji hydroelectric powerplant, the requirements for coal have fallen and will continue to fall for several years. It has been projected by the Nigerian Coal Corp., owner of the Enugu mines, that only one of the four mines in operation prior to the crisis will be rehabilitated in the near future. All four mines are now water flooded because of nonoperation during the war. Currently, N.N.D.C. is completing the contract it signed during the crisis to produce 300,000 tons of Okaba coal during a 3-year period. At the end of the contract, the Okaba mines will be taken over by Nigerian Coal Corp., and the projected annual requirement for coal of 250,000 tons, barring the discovery of coking coal for an iron and steel complex, will be shared equally between Enugu and Okaba mines.

Natural Gas.—The percentage of natural gas production that was actually utilized as a fuel was rising prior to the war; however, in 1969 the share utilized had fallen to only 1.5 percent of gross production. Of the 145.7 billion cubic feet produced that year, only 2.3 billion cubic feet were used. Whereas oil company use in the fields and at pumping stations increased during 1969, the closure of the Afam thermal powerplant, destruction at the Port Harcourt refinery, and damage to industrial facilities in Aba and Enugu influenced the overall decline. With the advent of the economic feasibility of tanker shipments of natural gas in its liquid state, the Shell-BP Petroleum Development Company of Nigeria, Ltd. (Shell-BP) has indicated an interest in exporting natural gas to the United States.

Petroleum.—By the end of 1969, about 2 weeks before the formal ending of the civil war, it was apparent that the Nigerian petroleum industry was going to make a rapid recovery from the crippling effect of the hostilities. Crude oil production during December 1969 averaged 630,555 barrels daily compared with the prewar monthly high of 582,000 barrels per day in April 1967. Nigerian officials have estimated that daily production should exceed 1 million barrels by mid-1970 and reach 2 million barrels before the end of 1971.

Damage to petroleum industry facilities included extensive damage to the Port Harcourt and Bonny terminal. By yearend 1969, Bonny terminal was functional but below prewar capacity. Other damage included sabotage to pipelines, pumping stations, and field facilities located just east of the Niger River and belonging to Nigerian Agip Oil Co., Ltd. (Agip), Phillips Petroleum Co., Safrap (Nigeria), Ltd., and Shell-BP. Because most of the latter facilities were vulnerable to infiltration and possible sabotage, none were operational during 1969. By the end of the year, only five of the country's 25 fields in production before the fighting broke out were not back on stream. Together with new fields, 28 oilfields were in operation at yearend 1969.

Shell-BP, the largest oil company in Nigeria (about 353,785 barrels per day in 1969) has announced a record $156 million budget for 1970. The emphasis will be on expansion. Exploration will be intensified in the Mid-Western and Central Eastern States and offshore. The company anticipates that at least nine drilling rigs and five workover units will be in operation during 1970. Existing pipelines are to be repaired and/or extended and new lines are to be built. One new line to be built is the long-planned system to connect fields in the swampy Rivers State to Bonny terminal. Work is to begin on a line from the promising Jones Creek oilfields to the Trans-Niger pipeline which terminates at Forcados. Temporarily, a 110,000-deadweight-ton tanker is being used for storage at the war-crippled Forcados terminal where eight 700,000-barrel crude oil storage tanks are to be built. Furthermore, two single-point mooring buoys for handling 200,000-deadweight-ton tankers are to be built 12 miles offshore from Forcados.

At present the damaged 30,000-barrel-per-day Port Harcourt refinery is the only one in Nigeria. The owner, Shell-BP, expects the plant on stream by May 1970 and plans to increase capacity later. The Government has called for applications to build Nigeria's second refinery, to be built in the Lagos area.

Output by Gulf Oil Corp., the only other company to produce during the war,

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Table 4.—Nigeria: Oil concessions and oil well drilling activity, 1969

Operating company	Exploration activity			Exploitation activity		
	Licenses (square miles)	Number of wells drilled	Footage drilled	Leases (square miles)	Number of wells drilled	Footage drilled
Nigerian Agip Oil Co., Ltd (Agip) [1]	-----	-----	-----	2,031	6	43,712
American Overseas Petroleum Ltd (Amoseas) [2]	-----	-----	-----	992	-----	-----
Delta Oil (Nigeria), Ltd	958	-----	-----	-----	-----	-----
Great Basins Petroleum Co. (Nigeria), Ltd	9,873	-----	-----	-----	-----	-----
Nigerian Gulf Oil Co., Ltd	981	3	28,228	4,978	32	198,374
Mobil Exploration Nigeria, Ltd	-----	2	19,010	1,024	28	250,764
Phillips Petroleum Co	475	1	7,602	-----	1	786
Safrap (Nigeria), Ltd	8,192	-----	-----	1,170	1	9,825
Tenneco Oil Company of Nigeria, Inc.[3]	120	2	20,896	872	-----	-----
Shell-BP Petroleum Development Company of Nigeria, Ltd (Shell-BP)	-----	12	121,280	16,622	64	677,846
Union Oil Company of Nigeria	1,989	-----	-----	-----	-----	-----
Total	22,588	20	197,016	27,689	132	1,181,307

[1] Phillip Petroleum Co. acquired 50 percent of this company's interests in Nigeria in 1965.
[2] Held jointly by Texaco, Inc., and Standard Oil Co. of California.
[3] Sunray DX Nigeria, Inc., now a subsidiary of Sun Oil Co., has held 25 percent of this company's interest in Nigeria since 1964.

averaged 186,500 barrels per day in 1969. Production came from five offshore fields: Okan, Meren, Delta, South Delta, and Meji. Three new offshore fields—Matu, Parabe, and Eko—will be put on stream by the end of 1970 when pipeline and production facilities are completed. Gulf's 1,200,000-barrel storage terminal in the Escravos area is to be expanded by 400,000 barrels.

Safrap (Nigeria), Ltd., the only other company with production before June 1967, has not announced plans to reactivate its Obagi field, which produced about 40,000 barrels per day before being shut down.

Mobil Exploration Nigeria, Ltd., which had planned to commence production from its offshore Idoho (formerly called Satun) field in July 1967, has rescheduled startup for February 1970. Production, which is expected to reach 50,000 barrels per day, is to be stored in an 80,000-deadweight-ton tanker. Construction of a new terminal near the mouth of the Qua Ibo River in the South-Eastern State is expected to begin in early 1970.

Amoseas, jointly owned by subsidaries of Texaco, Inc., and Standard Oil Co. of California, is planning to begin production of its Pennington offshore field at 4,000 barrels per day, to be increased to about 15,000 barrels per day by yearend 1970. In early 1970 an active exploration program was underway and an offshore rig was drilling in the Apoi area.

Agip and Phillips Petroleum Co. are in partnership in the exploitation of two fields, Ebocha and Mbede. Agip is the concession operator. These fields were about to go into production before the war when a pipeline was completed to the Rumuekpe pumping station. The pumping station was badly damaged and sections of the pipeline were destroyed. It is the operator's hope to have essential repairs completed before the end of 1970.

The partnership of Tenneco Oil Company of Nigeria, Inc., and Sunray DX Nigeria, Inc., holds an exploitation concession at Kanuskiri near the mouth of the Brass River. Tenneco is the concession operator. There have been no developments reported concerning the agreement Tenneco had with other oil companies in the area to build a terminal and storage facilities on the Brass River estuary.

At yearend 1969, plans of other companies with exploration rights in Nigeria had not been reported. Great Basins Petroleum Co. (Nigeria), Ltd., closed its office in Nigeria during November 1969. Union Oil Company of Nigeria plans to drill a well in its concession area offshore from Lagos. This will be the most western oil well drilled in either onshore or offshore Nigeria.

The Government issued a new law known as Decree No. 51, the Petroleum Decree–1969. The new law had been expected for years. It repeals and replaces the basic Mineral Oils Act which dates back to 1914, and consolidates various existing Government powers over all phases of the industry in the offices of the Commissioner of Mines and Power and the

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Table 5.—Nigeria: Summary of petroleum drilling and geophysical activity

Activity	1967	1968	1969
Exploration wells drilled:			
Productive	28	19	4
Dry	51	19	16
Total	79	38	20
Success ratio, percent	36	50	20
Footage drilled	814,800	332,300	197,016
Development wells drilled:			
Productive	62	78	105
Dry	18	10	27
Total	80	88	132
Footage drilled	828,900	915,800	1,181,307
Total drilling:			
Productive	90	97	109
Dry	69	29	43
Total	159	126	152
Footage drilled	1,643,700	1,248,100	1,378,323
Geophysical activity:			
Land or swamp, party-months	98	54	72
Offshore, do	10	3	5
Total, do	108	57	77

Chief Petroleum Engineer. The decree establishes Federal ownership of all petroleum, whether under land, territorial waters, or the Continental Shelf. The Continental Shelf, as defined, extends to depths no greater than 200 meters. It established fees, minimum areas, and durations for nonexclusive oil exploration licenses, exclusive oil prospecting licenses, and oil mining (exploitation) leases. The new legislation also provides that the Commissioner of Mines may, at his discretion, impose special terms to provide for "participation by the Federal Military Government in any venture on terms negotiated between the Commissioner and the applicant for a license or lease." In general, the new law has been described as one that will favor foreign capital participation in the continuing development of Nigeria's petroleum industry.

Another recently approved decree, retroactive to April 1, 1969, provides for a wider split of oil revenues among the poorer states of Nigeria. Under the new law, 45 percent of the revenue from oil goes to the State in which the oil is produced. Another 5 percent goes to the Federal Government while the remaining 50 percent is put into a pool. Half of the pool is split equally between the 12 States and the other half is divided among the States in proportion to population. The law is applied to all exports and could give a fair balance of income without causing the interstate friction.

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The Mineral Industry of Norway

By F. L. Klinger [1]

Norway's mining and mineral-processing industries continued to expand in 1969. Production of most commodities exceeded the high levels of 1968, and Norway remained a leading exporter of aluminum, ferroalloys, ilmenite, magnesium, nickel, silicon, and nonmetallic commodities such as cement and feldspar to European and North American markets. The increased industrial activity also led to higher imports of metallurgical raw materials and fuels. Expansions of productive capacity were underway or planned in mining of copper, ilmenite, and pyrite; in smelting of aluminum, ferroalloys, and magnesium; and in petroleum refining. Exploration for oil and gas in the North Sea was active, and an encouraging show of oil was found 50 miles south of the Cod gasfield discovered in 1968.

The problem of developing additional electric power sources by 1980 at the lowest possible cost, of critical importance to Norway's metallurgical and chemical industries, was being studied intensively in 1969, particularly in regard to supplementing hydroelectric sources with thermal plants using conventional or nuclear fuels. In another development, the future of the Falconbridge nickel refinery at Kristiansand was affected by Canadian minerals legislation in 1969 which requires metallic ores mined in Ontario to be smelted and refined in Canada. New sources of raw materials may have to be found for the Norwegian refinery by 1974.

PRODUCTION

Gains in production were evident in all of the main branches of the mineral industry in 1969, as shown by the following indices (1961 = 100):

	1967	1968	1969
Mining and quarrying:			
Coal mines	121	96	115
Metal mines	180	198	217
Mineral quarries	192	165	194
Stone, sand and gravel	120	129	145
Mineral processing:			
Primary metals	155	176	191
Nonmetallic mineral manufacturing	134	141	147
Coal and petroleum	141	195	208
Chemicals	160	163	170
All mining and quarrying	167	178	194
All industry	139	145	152

Source: Statistisk Sentralbyrå (Oslo). Statistisk Månedshefte (Monthly Bulletin of Statistics). No. 7, 1970, pp. 17–18.

In mining and quarrying, the indices for 1969 primarily reflect gains in production of iron ore, ilmenite, copper concentrate, pyrite, nepheline syenite, and coal. In the processing industries, the largest volume increases occurred in aluminum, ferroalloys, steel, cement, fertilizer materials, and petroleum products. There were also significant increases in output of small-volume but high-value commodities such as nickel, magnesium, copper, and silicon, and a slight decline in output of zinc.

[1] Physical scientist, Bureau of Mines, Washington, D.C.

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Table 1.—Norway: Production of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Aluminum:			
Alumina •	15,000	17,000	11,000
Metal:			
Primary	360,983	r 468,299	502,164
Secondary	14,055	13,051	NA
Superpure •	2,900	3,000	3,000
Cadmium	84	87	86
Cobalt	509	r 643	735
Copper:			
Mine output, metal content:			
In copper concentrate	8,600	r 9,890	13,495
In cupriferous pyrite	5,853	r 6,886	7,336
Metal, primary:			
Blister	20,302	r 23,583	27,853
Refined	14,102	18,160	22,063
Iron and steel:			
Iron ore and concentrate—thousand tons	3,235	3,704	3,795
Roasted pyrite—do	83	113	• 135
Pig iron—do	637	r 674	684
Ferroalloys:			
Ferrosilicon (45 percent basis)—do	288	r 356	333
Ferromanganese—do	135	170	191
Ferrosilicomanganese—do	134	r 142	149
Other—do	38	47	73
Total ferroalloys—do	595	r 715	746
Steel, ingots and castings—do	r 795	r 812	854
Semimanufactures:			
Rolled products—do	632	655	NA
Wire, uncoated—do	40	47	NA
Lead, mine output, metal content	3,320	3,531	• 3,200
Magnesium metal, primary	30,454	r 31,286	35,127
Molybdenum, mine output, metal content	r 274	221	• 243
Nickel:			
Mine output, metal content	151	225	• 250
Metal, primary	28,159	32,172	35,600
Platinum-group metals (exports)—troy ounces	19,901	21,670	20,544
Selenium, elemental •	15	18	20
Silicon, elemental •	15,000	20,000	27,000
Titanium:			
Ilmenite concentrate	425,557	r 402,215	490,713
Dioxide •	12,000	15,000	17,000
Vanadium, mine output, metal content •	740	r 900	910
Zinc:			
Mine output, metal content	12,172	11,841	• 11,400
Metal, primary	54,801	60,110	58,886
NONMETALS			
Cement, hydraulic—thousand tons	2,152	r 2,297	2,480
Feldspar: [2]			
Lump	97,938	132,686	• 115,000
Ground and other	16,975	26,875	• 45,000
Fertilizer materials, manufactured:			
Nitrogen (total)—thousand tons	370	459	527
Nitrogenous:			
Ammonia—do	575	568	NA
Fertilizers—do	1,077	1,091	NA
Phosphatic—do	17	18	NA
Compound and other—do	606	714	NA
Graphite	r 7,558	r 8,271	• 8,000
Lime (quicklime and hydrated lime)	190,992	223,000	• 225,000
Mica (exports)	4,484	4,814	3,807
Olivine	86,750	89,300	• 90,000
Pyrite and pyrrhotite (including cupreous):			
Cupreous •	r 356,000	r 401,000	400,000
Other •	r 280,863	r 291,585	358,320
Total	636,863	r 692,585	758,320
Sulfur content	286,707	314,338	• 342,000
Quartz and quartzite, unground	414,868	538,070	NA
Stone, sand and gravel, n.e.s.:			
Dimension stone:			
Granite	5,887	135,990	NA
Marble	• r 6,000	41,430	NA
Syenite ("labrador")	40,106	41,917	• 43,000
Slate—thousand square meters	370	280	• 300

See footnotes at end of table.

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Table 1.—Norway: Production of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
NONMETALS—Continued				
Stone, sand and gravel, n.e.s.—Continued				
Crushed and broken stone (unground):				
Dolomite		340,725	388,838	e 400,000
Limestone	thousand tons	4,212	4,338	e 4,500
Nepheline syenite		65,210	83,023	e 130,000
Other, including gravel	thousand cubic meters	5,037	e 4,800	NA
Sand and gravel	do	4,933	4,797	NA
Sulfuric acid (100 percent)		214,147	r 261,526	303,000
Talc, soapstone, and steatite:				
Unground		79,295	74,955	e 70,000
Other		80,885	76,678	e 70,000
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades	thousand tons	427	346	392
Coke	do	302	310	325
Gas, manufactured	thousand cubic meters	29,176	r 25,361	30,678
Peat: e				
For agricultural use		7,880	9,850	10,000
For fuel use		3,845	4,060	4,000
Petroleum refinery products: [3]				
Aviation fuel	thousand tons	20	92	124
Gasoline	do	369	493	538
Kerosine	do	23	80	101
Gas/diesel oil	do	1,024	1,489	1,531
Residual fuel oil	do	1,381	2,100	2,411
Liquified petroleum gases	do	30	25	NA
Other, unspecified	do	171	337	376
Total refinery products	do	3,018	4,616	5,081
Total crude oil throughput	do	3,019	4,996	5,268

e Estimate. r Revised. NA Not available.
[1] According to information available August 1970.
[2] Not including nepheline syenite (see "Stone").
[3] Source: Organization for Economic Cooperation and Development (OECD; Paris). Provisional Oil Statistics, 4th quarter, 1969; also Statistics of Energy 1954–68.

TRADE

An export surplus in mineral commodities was again registered by Norway in 1969. Significant increases in exports of aluminum, ferroalloys, nickel, copper, magnesium and cement were mainly responsible. The surplus was valued at approximately $30 million, compared with $22 million in 1968.[2] The total value of mineral commodity exports in 1969 was roughly $785 million, of which metals and metallic ores accounted for an estimated 81 percent; nonmetallic commodities, 15 percent; and fuels (excluding electric power), 4 percent. West Germany was the principal country of destination, followed by the United Kingdom, Sweden, and the United States.

Imports of mineral commodities in 1969 were valued at roughly $755 million, an increase of about 12 percent compared with the previous year.[3] The principal increases were registered in iron and steel, nonferrous metals, and alumina. The value of imports of other major commodities such as nickel-copper matte, zinc concentrate, fertilizer raw materials, and fuels was relatively unchanged from the level of 1968 although the quantities, in some cases, were 5 to 10 percent less. Metals and metallic ores accounted for 62 percent of the total value, followed by fuels (28 percent) and nonmetallic commodities (10 percent). The principal supplying countries, with the share of each in the total value of imports of mineral commodities, were the United Kingdom (16 percent), Canada (13 percent), Sweden (12 percent) and West Germany (9 percent). Nickel-copper matte accounted for about 95 percent of the value of imports from Canada.

Norway's trade in mineral commodities in 1967 and 1968 is summarized in the following tables:

[2] Where necessary, values have been converted from Norwegian Kroner (NKr) to U.S. dollars at the rate of NKr 7.14=US$1.00.
[3] Based on a revised figure of $675 million for 1968.

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Table 2.—Norway: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum metal, including alloys:		
Scrap	3,788	5,588
Unwrought	314,918	435,197
Semimanufactures	7,767	12,330
Cadmium	66	76
Cobalt	484	511
Copper:		
Ore and concentrate	13,163	20,040
Metal, including alloys:		
Scrap	2,005	1,519
Unwrought:		
Unrefined	6,560	5,449
Refined	17,507	16,977
Semimanufactures	2,989	2,516
Gold, metal, unworked or partly worked, troy ounces	611	1,672
Iron and steel:		
Ore and concentrate, except roasted pyrite, thousand tons	2,506	2,741
Roasted pyrite	123,097	139,392
Metal:		
Scrap	6,379	29,617
Pig iron, including cast iron	155,346	192,717
Ferroalloys:		
Ferromanganese	120,514	143,753
Other	412,571	507,887
Steel, primary forms	175,273	163,819
Semimanufactures:		
Bars, rods, angles, shapes, sections	186,573	202,633
Universals, plates and sheets	64,274	74,028
Hoop and strip	366	3,616
Rails and accessories	138	192
Wire	5,872	6,738
Tubes, pipes, and fittings	21,920	24,498
Castings and forgings, rough	6,553	6,541
Total semimanufactures	285,696	318,246
Lead:		
Ore and concentrate	7,118	6,420
Metal, including ores:		
Scrap	4,015	4,809
Unwrought	532	521
Semimanufactures	188	402
Magnesium, metal, including alloys, all forms	30,112	27,070
Manganese ore and concentrate	2,351	1,610
Molybdenum ore and concentrate	502	417
Nickel:		
Ore and concentrate	r 2,925	4,251
Metal including alloys:		
Scrap	85	181
Unwrought	29,213	30,446
Semimanufactures	239	200
Platinum-group metals and silver:		
Waste and sweepings, kilograms	56,531	50,629
Metal, including alloys:		
Platinum-group metals, troy ounces	19,901	22,763
Silver, do	11,960	51,891
Selenium, elemental, value, thousands	$53	NA
Silicon, elemental	14,482	18,387
Tin metal, including alloys:		
Scrap, long tons	33	75
Unwrought, do	242	256
Titanium ore and concentrate (ilmenite)	349,762	395,987
Zinc:		
Ore and concentrate	15,361	18,090
Oxide	183	268
Metal, including alloys:		
Scrap	407	392
Unwrought	37,377	53,701
Semimanufactures	1,683	521
Other:		
Ore and concentrates	12	26
Ash and residues containing nonferrous metals	40,728	36,577
Oxides, hydroxides, and peroxides of metals, n.e.s	2,595	2,029
Base metals, including alloys, all forms	227	87
NONMETALS		
Abrasives (grinding and polishing wheels and stones)	1,055	1,205
Cement	612,969	840,596

See footnotes at end of table.

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Table 2.—Norway: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
NONMETALS—Continued			
Clay products:			
Refractory (including nonclay bricks)		6,131	11,023
Nonrefractory	value, thousands	$51	$1,146
Feldspar		107,095	131,148
Fertilizer materials:			
Manufactured:			
Nitrogenous	thousand tons	893	NA
Phosphatic	do.	4	8
Other	do.	270	NA
Ammonia	do.	92	NA
Graphite, natural		7,375	8,695
Lime		669	46
Mica, all forms		4,484	4,814
Pyrite (gross weight)		484,361	522,202
Salt		3,248	3,689
Sodium and potassium compounds:			
Caustic soda		5,042	NA
Caustic potash		24	-------
Stone, sand and gravel:			
Dimension:			
Crude and partly worked:			
Marble and other calcareous		2,572	5,474
Slate		47,327	47,710
Other		50,817	63,349
Worked, all types		247	164
Dolomite		91,084	95,474
Gravel and crushed rock		638,334	759,440
Limestone		14,782	14,285
Quartz and quartzite		7,359	6,374
Sand, excluding metal bearing		1,756	126
Sulfur:			
Sulfur dioxide		3,752	5,640
Sulfuric acid		58,715	NA
Talc, steatite, soapstone, pyrophyllite		76,109	72,950
Other nonmetals, n.e.s.:			
Oxides and hydroxides of magnesium, strontium, and barium		12,247	NA
Other		1,049	882
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		1,386	6,408
Coal and coke, including briquets:			
Anthracite and bituminous coal		140,358	67,473
Coke and semicoke		48,794	125,016
Peat, including peat briquets		78	40
Petroleum refinery products:			
Gasoline, including natural		193,066	254,491
Kerosine and jet fuel		7,406	2,489
Distillate fuel oil		975,673	1,238,272
Residual fuel oil			
Liquefied petroleum gas		21,652	15,565
Lubricants		20,891	21,835
Bitumen and other		344	162
Mineral tar and other coal, petroleum, or gas derived crude chemicals		21,349	22,116

r Revised. NA Not available.

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Table 3.—Norway: Principal destinations of selected mineral commodity exports, 1968
(Thousand metric tons)

Commodity	Quantity	Commodity	Quantity
METALS		METALS—Continued	
Aluminum, unwrought, total	435	Iron and steel—Continued	
United Kingdom	148	Steel, primary forms, total	164
West Germany	96	Denmark	60
United States	81	Netherlands	49
Iron and steel:		Ilmenite concentrate, total	396
Iron ore, total	2,741	West Germany [1]	223
West Germany	1,569	Italy	95
United Kingdom	954	United Kingdom	e 70
Pig iron, total	193	Magnesium, unwrought, total	27
United Kingdom	57	West Germany [1]	19
United States	56	United Kingdom	3
West Germany	29	Nickel, unwrought, total	30
Ferrosilicon, total	329	United States	10
United Kingdom	108	Sweden	6
West Germany	96	West Germany	5
Ferromanganese, total	144	United Kingdom	4
West Germany	45	Italy	2
United Kingdom	20	NONMETALS	
Belgium-Luxembourg	18	Cement, total	841
Netherlands	12	Ghana	289
Ferrosilicomanganese, total	132	United States	266
West Germany	50	Pyrite, unroasted, total	522
United Kingdom	22	West Germany	422
United States	15	MINERAL FUELS AND RELATED MATERIALS	
Other ferroalloys, total	47	Petroleum products, total	1,533
United Kingdom	13	Sweden	1,011
West Germany	9	United Kingdom	210
Sweden	8		

e Estimate.
[1] As reported by countries of destination.

Table 4.—Norway: Imports of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite	34,843	37,096
Oxide and hydroxide	702,091	932,244
Metals, including alloys:		
Scrap	299	587
Unwrought	12,397	21,583
Semimanufactures	12,037	10,489
Antimony metal, including alloys, all forms	86	121
Arsenic trioxide, pentoxide, and acids	83	107
Chromium:		
Chromite	63,016	69,617
Oxide	184	179
Cobalt:		
Oxide and hydroxide	2	3
Metal, including alloys, all forms	8	1
Copper metal, including alloys:		
Scrap	3	55
Unwrought	3,986	3,660
Semimanufactures	23,128	20,553
Gold metal, worked or partly worked, troy ounces	55,254	54,881
Iron and steel:		
Ore and concentrate	7,728	13,854
Scrap	24,021	12,956
Pig iron, ferroalloys and similar materials	19,968	20,266
Steel, primary forms	56,698	64,226
Semimanufactures:		
Bars, rods, angles, shapes, sections	234,780	230,622
Universals, plates and sheets	465,625	449,714
Hoop and strip	73,247	66,672
Rails and accessories	6,567	6,029
Wire	9,024	8,820
Tubes, pipes and fittings	66,076	70,148
Castings and forgings, rough	607	587
Total semimanufactures	855,926	832,592
Lead:		
Oxides	992	1,485
Metals, including alloys:		
Scrap	31	113
Unwrought	11,734	10,444
Semimanufactures	1,063	1,252

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Table 4.—Norway: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS—Continued		
Magnesium, metal, including alloys, all forms	96	268
Manganese:		
Ore and concentrate	534,704	650,632
Oxides	221	310
Mercury, 76-pound flasks	609	754
Molybdenum, metal, including alloys, all forms	4	--------
Nickel:		
Matte, speiss, and similar materials	52,833	77,710
Metal, including alloys:		
Scrap	190	697
Unwrought	230	91
Semimanufactures	350	305
Platinum-group metals and silver:		
Waste and sweepings, kilograms	70	244
Metal, including alloys:		
Platinum-group, troy ounces	2,701	8,638
Silver, thousand troy ounces	3,142	2,610
Tin, metal, including alloys:		
Scrap, long tons	16	24
Unwrought, do.	571	647
Semimanufactures, do.	422	459
Titanium:		
Ore and concentrate	219	142
Dioxide	1,124	964
Tungsten, metal, including alloys, all forms	3	2
Zinc:		
Ore and concentrate	81,548	113,015
Oxide	1,059	653
Metal, including alloys:		
Scrap	1,703	2,780
Unwrought	1,597	2,650
Semimanufactures	1,973	1,233
Other:		
Ore and concentrate	256	982
Ash and residues containing nonferrous metals	247	174
Oxides, hydroxides and peroxides of metals, n.e.s.	307	384
Metals, including alloys, all forms:		
Metalloids	12	49
Alkali, alkaline-earth, and rare-earth metals	33	
Pyrophoric alloys	3	3
Base metals, including alloys, all forms, n.e.s.	286	391
NONMETALS		
Abrasives:		
Pumice, emery, natural corundum	423	399
Grinding and polishing wheels and stones	727	629
Asbestos	5,683	4,725
Barite and witherite	1,187	16,327
Boron materials:		
Crude, natural borates	690	550
Oxide and acid	211	299
Cement	7,055	7,954
Chalk	7,831	7,581
Clays and clay products:		
Crude clays:		
Fuller's earth, dinas, chamotte	1,971	2,204
Kaolin	67,751	73,923
Other	41,979	47,267
Products:		
Refractory (including nonclay bricks)	36,367	22,787
Nonrefractory, value, thousands	$3,260	$3,053
Cryolite and chiolite	4,315	4,432
Diamonds:		
Gem, not set or strung, carats	10,000	210,000
Industrial, do.	40,000	--------
Diatomite and other infusorial earths	5,043	4,234
Feldspar	18	24
Fertilizer materials:		
Crude:		
Nitrogenous	316	--------
Phosphatic	238,569	313,551
Manufactured:		
Nitrogenous	316	667
Phosphatic	6,763	9,410
Potassic	177,968	193,808
Other	21,638	74
Ammonia	5,503	67,858
Fluorspar	2,421	2,819
Graphite, natural	386	347
Gypsum and plasters	96,827	138,618

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Table 4.—Norway: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968
NONMETALS—Continued		
Lime	13,941	13,027
Magnesite	2,348	5,129
Mica, all forms	4,913	5,660
Pigments, mineral:		
Natural, crude	387	483
Iron oxides processed	1,861	1,927
Precious and semiprecious stone, except diamond, including synthetic stone, dust and powder, kilograms	306	300
Salt and brine	268,641	322,646
Sodium and potassium compounds:		
Caustic soda	13,106	19,469
Caustic potash, sodic and potassic peroxides	1,473	1,327
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked:		
Calcareous	286	279
Slate	1,334	2,559
Other	374	1,445
Worked, all types	792	832
Dolomite	2,977	2,580
Flint	1,451	1,181
Gravel and crushed rock	14,900	38,727
Limestone	224,631	268,859
Quartz and quartzite	48,039	80,077
Sand, excluding metal bearing	138,911	151,284
Sulfur:		
Elemental	37,751	26,274
Sulfuric acid	1,486	858
Talc, steatite, soapstone, and pyrophyllite	4,410	6,017
Other nonmetals, n.e.s.:		
Crude	69,143	58,646
Slag, dross and similar waste, not metal bearing	43,096	58,374
Oxides and hydroxides of magnesium, strontium, and barium	181	294
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	1,622	1,279
Carbon black and gas carbon	3,329	3,795
Coal and coke, including briquets:		
Anthracite and bituminous coal	421,575	587,532
Lignite and lignite briquets	143	-------
Coke and semicoke	680,931	692,356
Peat, including peat briquets and litter	2,624	3,660
Petroleum:		
Crude and partly refined, thousand tons	3,192	4,926
Refinery products:		
Gasoline (including natural), do	596	480
Kerosine and jet fuel, do	325	287
Gas, hydrocarbon, value, thousands	$4	$223
Distillate fuel oil, thousand tons	2,822	1,101
Residual fuel oil, do		1,067
Lubricants, do	55	57
Other, bitumen, do	272	435

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Table 5.—Norway: Principal sources of selected mineral commodity imports, 1968
(Thousand metric tons)

Commodity	Quantity	Commodity	Quantity
METALS		NONMETALS	
Aluminum oxide, hydroxide, total	932	Fertilizer materials:	
Jamaica	274	Phosphate, crude, total	314
United States	236	U.S.S.R.	137
Surinam	179	Morocco	59
Guinea	135	Togo	44
Iron and steel:		United States	41
Chromite, total	70	Potassium salts, total	194
Turkey	46	Spain	85
U.S.S.R.	22	France	58
Manganese ore, total	651	West Germany	31
Ghana	252	MINERAL FUELS AND RELATED MATERIALS	
Brazil	124	Coal, total	538
Republic of South Africa	94	United States	246
U.S.S.R.	51	United Kingdom	142
Steel, primary forms, total	64	Poland	86
Netherlands	56	Coke, total	692
Semimanufactures:		United Kingdom	502
Bars, rods, sections, etc., total	231	West Germany	112
West Germany	66	Petroleum, crude, total	4,926
France	53	Libya	1,192
Sweden	37	Venezuela	1,189
Sheets and plates, total	450	Saudi Arabia	676
West Germany	108	Muscat and Oman	561
United Kingdom	100	Iraq	495
Sweden	65	Kuwait	405
Nickel matte, total	78	Iran	263
Canada	78	Petroleum products, total [1]	3,427
Zinc concentrates, total	113	United Kingdom	1,179
Sweden	65	Sweden	377
Australia	27	U.S.S.R.	373
Canada	21	Netherlands	327
		United States	231

[1] Excluding liquefied petroleum gases.

COMMODITY REVIEW

METALS

Aluminum.—The Norwegian aluminum industry continued to expand in 1969. Compared with 1968, imports of alumina increased 6 percent, while production of primary metal rose 7 percent and there was a 10-percent gain in exports of ingots. Exports of aluminum ingots were valued at $245 million.

A/S Årdal og Sunndal Verk (ASV) remained the major producer, accounting for almost 50 percent of Norwegian production. The company also produced 28,000 tons of aluminum semimanufactures and finished products from five fabricating plants in southern Norway. ASV smelters at Årdal and Sunndalsøra were the largest in Western Europe.

Norwegian productive capacity for aluminum was expected to increase to at least 637,000 tons annually by 1972 and to more than 700,000 tons annually by 1974. At yearend 1969, capacity installed, under construction or planned by the various producers was estimated as follows:

Producing company and plant	Annual productive capacity (thousand metric tons)		
	Installed	Under construction	Planned
A/S Årdal og Sunndal Verk:			
Årdal	116	52	---
Sunndalsøra	120	---	---
Høyanger	29	---	---
Mosjøen Aluminium A/S:			
Mosjøen	86	---	---
Lista	---	30	70
A/S Alnor—Karmøy	90	20	---
Sør-Norge Aluminium A/S—Husnes	60	---	10
Det Norske Nitrid A/S:			
Tyssedal Eydehavn	84	---	---
Total	585	102	80

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Future increases in productive capacity were uncertain, partly because of construction of large smelters in the United Kingdom and West Germany and partly because the cost of additional electric power in Norway was expected to rise. As the more economical sources of hydroelectric power have already been tapped, alternative sources of energy were being considered. In 1969, a report by the National Energy Council recommended that thermoelectric power be used to augment the national supply, with construction of nuclear powerplants as soon as economically feasible.

Cobalt.—Increased production of cobalt from the Kristiansand nickel refinery was exceeded by exports, which rose to 960 tons in 1969.

The refinery was expected to receive shipments of cobalt matte from Uganda in 1971. The matte was to be produced from cobaltiferous pyrite stockpiled at Kilembe Mines, a subsidiary of Falconbridge Nickel Mines, Ltd. The Kilembe stockpile was reported to contain 700,000 tons of pyrite with a cobalt content of 1.3 percent.

Copper.—A 40-percent rise in production and a 75-percent increase in exports of copper concentrates in 1969 were mainly due to a full year's production from the new Tverfjellet mine near Hjerkinn. The mine was producing ore at the rate of at least 400,000 tons annually, which may increase to 600,000 tons annually in 1970. Crude ore reserves were reportedly increased to 14 million tons, about 75 percent more than the figure reported in 1967. Copper content ranges between 0.7 and 2.0 percent. The mine was operated by Folldal Verk A/S, a subsidiary of A/S Borregaard. Concentrates of pyrite and zinc are also produced.

A 10-percent increase in production of copper concentrate was also reported by A/S Sulitjelma Gruber, the other major producer. Output by the company at Fauske was 21,700 tons of copper concentrate in 1969, and exports of blister copper increased about 5 percent compared with those of 1968.

The Borregaard company may begin mining a copper deposit at Repparfjord, 30 miles east of Hammerfest, in 1973. Crude ore reserves were estimated at 10 million tons, with an average copper content of 0.7 percent.

In Finnmark, the Bidjovagge deposit of cupriferous pyrite was being prepared for mining in 1970 by A/S Bleikvassli Gruber. Initial production was expected to be at the rate of 250,000 tons of ore annually. Crude ore reserves were reported to be 5 million tons, containing an estimated 1.5 percent copper.

Another deposit of cupriferous pyrite was being developed in the Grong region of North Trøndelag Province. The deposit, located near Joma about 28 miles northeast of the Skorovas pyrite mine at Namsskogan, contains proved ore reserves of 15 million tons with average metal contents of approximately 1.5 percent copper and 0.8 percent zinc. Production was expected to begin in 1972 at the rate of 250,000 tons of ore annually. The developing company was A/S Grong Gruber, owned 50 percent by Elkem A/S and its subsidiary, A/S Sulitjelma Gruber; other participants were A/S Sydvaranger and A/S Årdal og Sunndal Verk. The property was leased from the Government.

A 20-percent increase in production and exports of refined copper in 1969 was due to increased output from the Falconbridge refinery at Kristiansand.

Iron and Steel.—Production, exports, and domestic consumption of iron ore in 1969 were close to the relatively high levels of 1968. Expansions of production facilities at the principal mines, in progress for the last 3 years, were apparently completed by yearend. The pelletizing plant of A/S Sydvaranger was completed in September, produced 260,000 tons of pellets by yearend, and was expected to produce at capacity (1.2 million tons) in 1970. Sydvaranger remained the major producer with an estimated 63 percent of the national output, followed by the Rana mine (20 percent), the Fosdalen mine (10 percent), the Rødsand mine (4 percent), and other mines (3 percent). Production of byproduct magnetite at the Tellnes ilmenite mine was expected to increase to about 50,000 tons annually under the expansion program started by A/S Titania.

Export prices of iron ore, as negotiated by A/S Sydvaranger for shipments in 1970, were reported to be 10 percent higher than those of the previous year. This reversed a 9-year decline.

Ferroalloys.—Output and exports of ferroalloys continued to increase. Exports in 1969 were 11 percent above the level of 1968, mainly because of a 44,000-ton in-

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crease in shipments of ferromanganese. Ferrosilicon remained the leading commodity, with exports of 346,000 tons in 1969. The value of all ferroalloys exported rose to nearly $86 million.

Production capacity for ferrosilicon was increased in 1969 by the completion of a 35,000-ton-annual-capacity furnace by A/S Hafslund at Skjeberg. The new ferrosilicon furnace being constructed at Salten by Elkem A/S (formerly Elektrokemisk A/S) was nearly completed and will double the output capacity at Salten Verk to 80,000 tons annually. Christiania Spigerverk (CS) planned to expand ferrosilicon production at Svelgen by building a new furnace at the company's Bremanger works. CS also produces ferrovanadium and silicon metal at Svelgen.

A 25,000-kilowatt furnace for production of silicon metal was under construction at Kopperå by A/S Meraker Smelteverk, a subsidiary of Union Carbide Corp. The cost of the project, including new port facilities, was reportedly $4.7 million. Completion of the project was scheduled for mid-1972. In addition to the Meraker firm, silicon was also produced at the Fiskaa works of A/S Elkem. Exports of silicon from Norway increased more than 40 percent in 1969, to 26,000 tons valued at $7.8 million.

Steel.—Output of crude steel in 1969 exceeded the 840,000 tons of effective capacity reported for Norway by the Organization for Economic Cooperation and Development (OECD). Exports of steel products were close to the levels of 1968, but imports increased by more than 200,000 tons and apparent domestic consumption rose to an estimated 1.5 million tons. Inadequate rolling facilities for flat products continued to hinder Norway's self-sufficiency in steel; large quantities of slabs were exported to Denmark and the Netherlands for rolling and return to Norway, and imports of plates and sheets increased to a record total of 540,000 tons in 1969. A sharp increase in imports of iron and steel pipe also occurred—from 70,000 tons in 1968 to 141,000 tons in 1969.

The State-owned steelworks of A/S Norsk Jernverk at Mo-i-Rana continued to account for the bulk of crude steel produced. CS, the other major producer, was reported to be expanding production capacity at Oslo to 180,000 tons annually.

Magnesium.—The record output of magnesium in 1969 reflected strong foreign demand, as well as increased production capacity. Exports of magnesium were valued at $19.4 million, 24-percent higher than in 1968. Norsk Hydro, the only producer, had increased production capacity at Herøya to 36,000 tons annually in 1968; this was increased by an unspecified amount in 1969 through technological improvements, and a new process will reportedly be used by the company to raise the production capacity to 40,000 tons annually in the near future.

Nickel.—A/S Titania continued to produce a nickel concentrate at Tellnes. The concentrate contains approximately 5 percent nickel. Increased output was indicated in 1969, as exports rose 20 percent to 5,080 tons, all of which was destined for Finland. It was not known whether the concentrate was recovered as a byproduct from the Tellnes ilmenite ore or was produced from a separate mine. Production of the concentrate was first reported in 1967.

Imports of nickel-copper matte from Canada in 1969 totaled about 7,900 tons less than in 1968, but the reported value ($91.5 million) was almost identical with that of the previous year. The increase in production and exports of refined nickel (and copper) from the Kristiansand refinery of Falconbridge Nikkelverk A/S was mainly derived from stocks of unfinished matte and metal, as the shipments of matte were curtailed by a 3-month strike in the Sudbury district of Canada. The monthly output of nickel from the refinery dropped to 1,334 tons in November, compared with an average 3,300 tons during the first 9 months of the year, and to alleviate the shortage of supply, 47 air cargoes of matte, totaling about 1,600 metric tons, were flown to Norway by Falconbridge Nickel Mines, Ltd., immediately after the strike.

Of particular significance to the future of the Kristiansand refinery was a change in the Ontario (Canada) Mining Act in 1969. The Act now requires metals derived from all ores mined in Ontario to be refined to a usable form in Canada. The Canadian Government granted Falconbridge a temporary exemption from the new legal requirement but directed the company to provide refining facilities in Canada by yearend 1974 for 51 percent of the ores produced in Ontario. This requirement was expected to substantially reduce opera-

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tions at Kristiansand unless new sources of raw materials can be found. Norwegian output of refined cobalt, copper, and platinum-group metals is also based on the Canadian matte.

Titanium.—Production capacity for ilmenite concentrates at Tellnes will be doubled by A/S Titania, a subsidiary of the National Lead Co. The projected expansion, costing $6 million, will raise output capacity to 1 million tons annually. The initial phase of the project was expected to increase capacity to 650,000 tons annually by late 1970.

The sharp rise in production in 1969 was accompanied by a 59,000-ton increase in exports, most of which went to West Germany where a $30 million plant for production of titanium pigments was brought on stream by Titangesellschaft m.b.H. in 1969. The new plant, located at Nordenham, uses the sulfate process and has a production capacity of 36,000 tons of titanium dioxide annually. Titangesellschaft m.b.H., the West German subsidiary of the National Lead Co., also operated titanium dioxide plants at Leverkusen with annual production capacities of 86,000 tons (sulfate process) and 18,000 tons (chloride process).

In a related development, National Lead planned to expand the production capacity of another Norwegian subsidiary, Titan A/S, by 30 percent to 19,500 tons of dioxide annually.

NONMETALS

Cement.—Despite evidence of increasing activity in the domestic construction industry in 1969, the rise in output of cement appeared destined entirely for export. Exports increased by nearly 30 percent in 1969, with the total quantity exceeding 1 million tons for the first time. Shipments to North America (principally the United States) rose to 320,000 tons.

Feldspar, Nepheline-Syenite, and Quartz.—Exports of these commodities increased sharply in 1969. Exports of ground feldspar rose by 30,000 tons, while shipments of quartz jumped to 91,000 tons compared with 6,000 tons in 1968. The increase in exports was probably due to the first year's operation of the large flotation plant completed at Lillesand in 1968.

Production and exports of nepheline syenite increased for the eighth consecutive year. Exports rose to 129,000 tons, 60 percent more than in 1968. A/S Norsk Nefelin, a subsidiary of CS, was the only producer. The rock was quarried at Stjernøy, in the Lofoten Islands.

Fertilizer Materials.—Production of superphosphate and phosphorus-potassium fertilizers was discontinued in 1969 at the Eitrheim plant of Det Norske Zinkkompani. The company will use part of its output of sulfuric acid for the manufacture of aluminum fluoride.

Norsk Hydro expected to have a production capacity of 1 million tons of complex fertilizers annually by mid-1970, after modernization of older plants at Herøya and Glomfjord. The company had increased productive capcity by 400,000 tons annually in 1967 when it completed a new plant at Herøya.

Exports of manufactured fertilizers in 1969 were valued at $54 million. Calcium nitrate remained the principal item but the share of complex fertilizers rose to 37 percent of the total value, compared with 28 percent in 1968. Norsk Hydro was the major producer.

Pyrite and Sulfur.—Rising production of copper-zinc-pyrite ore at the Tverfjellet mine appeared to account for most of the increase in Norwegian output of pyrite concentrates and sulfuric acid in 1969. The concentrates were shipped by rail to the acid plant of A/S Borregaard at Sarpsborg. Production of pyrite increased at the Skorovas mine of A/S Elkem, to 160,000 tons, while output of Sulitjelma at Fauske declined slightly although production of crude ore apparently increased.

Exports of pyrite in 1969 declined 3 percent compared with 1968, but prices were lower and the total value declined by 6 percent, to $8.4 million. Imports of elemental sulfur rose to 34,000 tons.

Increasing production of pyrite was likely to take place from expanding production at Tverfjellet and also the cupriferous deposits at Bidjovagge in north Norway in 1970. Mining of deposits near Joma by A/S Grong Gruber, scheduled to begin in 1972, was expected to yield 110,000 tons of pyrite annually. The Grong concentrate will be stored under water until suitable markets are found.

Talc.—The processing plant of A/S Norwegian Talc, at Bergen, was reportedly damaged by fire late in 1969, causing a loss of production. Repairs were expected

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to be completed by mid-1970. Exports of talc declined to 63,000 tons in 1969.

MINERAL FUELS

Coal and Coke.—Production of coal from Spitzbergen increased in 1969 but was still below 1964–67 levels. Store Norske Spitzbergen Kulkompani, the only producer, planned to increase output in 1970 to 500,000 tons. Exports remained low, at 62,000 tons in 1969, while imports increased to 552,000 tons of which about 40 percent came from the United States. Coking coal from the U.S. was mixed with Spitzbergen coal for production of metallurgical coke.

Output of coke by Norsk Koksverk A/S increased in 1969 but imports of coke were also increased to 727,000 tons. Rising demand from the electrometallurgical industry led to imports of 269,000 tons of petroleum coke, compared with 250,000 tons in 1968 and 193,000 tons in 1967.

Petroleum.—*Exploration.*—About 15 exploration wells were reportedly drilled in the Norwegian sector of the North Sea in 1969, four more than in 1968. An unspecified quantity of gas found by the Murphy exploration group in Block 2/3, about 140 miles from the Norwegian coast. In November, "important indications" of oil were found by the Phillips group in a hole named Ekofisk 1A, about 50 miles south of the Cod gasfield discovered by the group in 1968, but productive potential of the well could not be tested because of bad weather. The Ekofisk well was located near the United Kingdom offshore boundary, about 185 miles southwest of Norway and 200 miles east of Aberdeen, Scotland. Evaluation of the well and additional drilling in the area was planned for the spring.

Thirteen additional exploration licenses were awarded by the Government in 1969. Esso Exploration Norway, Inc., and A/S Petronord each received four; A/S Norske Shell and the Amoco-Noco group each received two and one was awarded to the Phillips group. The Government continued to award licenses only for areas south of 62 degrees latitude.

North of 62 degrees latitude, Government-sponsored geophysical work was being carried out, and surveys in the Spitzbergen area were planned with the participation of Norsk Polarinstitutt and Norsk Polar Navigasjon A/S. Many companies were reported to be interested in exploration of the northern area, which comprises about 80 percent of the Norwegian Continental Shelf. The Government may open the region in mid-1971.

Refining.—Output of petroleum refineries increased about 5 percent in 1969, as imports of crude oil rose to 5.15 million tons. Increased imports of petroleum products were necessary, however, as inland consumption grew by more than 12 percent. Domestic consumption in 1968 and 1969 was as follows, in thousand metric tons:

	1968	1969
Aviation fuels	188	193
Gasoline	807	901
Kerosine	262	311
Gas/diesel oil	2,040	2,294
Residual fuel oil	2,067	2,343
Other	615	706
Total	5,979	6,748

Source: Organization for Economic Cooperation and Development (OECD; Paris). Provisional Oil Statistics, 4th quarter 1969.

Expansion of capacity at the Slagen refinery of A/S Norske Esso was apparently completed in 1969 to 86,000 barrels per day. Capacity of the Sola refinery of A/S Norske Shell was 46,000 barrels per day.

Norsk Hydro was studying the feasibility of constructing a petroleum refinery. The proposed plant would have a capacity of 2 million tons annually and would be located in the southern part of Vestfold County. The company was an important consumer of oil products, using 650,000 tons in 1969.

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The Mineral Industry of Pakistan

By Charles L. Kimbell [1]

Through 1969, Pakistan remained a minor producer and consumer of mineral commodities among the world's nations. From the viewpoint of known resources, only the country's natural gas was of major economic significance by world standards. Reserves of some low-unit-value nonmetals appear appreciable. Despite the industry's modest role from the world veiwpoint, it has been and will remain of considerable significance to the domestic economy, both as a part of the base for general development and as a limited, but important, earner of foreign exchange, particularly in view of the nation's unfavorable overall trade balance.

In 1969, mineral industry development efforts continued to stress improving the nation's self sufficiency, but recognized the inability of the country to enjoy general economic growth without significant imports of mineral commodities. In this area, attention continued to be given to providing processing facilities for crude mineral imports in lieu of importing higher unit value products.

The relative imbalance between East and West Pakistan in regard to mineral resources and consumption remained evident in 1969. The mineral-poor Eastern area, with over half the population again contributed little to the nation's total mineral production and supplied only a tiny fraction of mineral exports. It also received a smaller share of imports of these materials than would be suggested on the basis of population distribution.

Official Pakistani sources credit crude mineral extraction with a contribution of only U.S. $39 million [2] in current dollars to the gross national product of $14,211 million recorded provisionally for the fiscal year ending June 30, 1969. (Comparable final figures for the previous fiscal year were $36 million and $12,943 million, respectively.) Data on value added as a result of processing both domestic and imported mineral commodities are not available, but the figure is clearly much greater than the crude mineral contribution in view of the fact that the nation's petroleum operations alone were expected to add about $202 million to Government revenue, chiefly from duties and special surtaxes in the year ending June 30, 1969.

PRODUCTION

Data on Pakistan's 1969 mineral output were incomplete at this writing; for most commodities, figures were available for only the first 9 months of the year. Nevertheless, on the basis of this information, it appears that there was a modest upturn in mining and mineral processing activity overall, with only a relatively few commodities not registering gains. Most notable increases among commodities for which preliminary total year output was recorded were manufactured fertilizers, rock salt soda ash, natural gas, and crude oil. Among commodities for which only partial year data were available, gypsum, mineral pigments, and limestone recorded sizable gains during the first 9 months, and the higher levels of production were believed to have prevailed during the final quarter.

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[1] Physical scientist, Bureau of Mines, Washington, D.C.

[2] Where necessary, values have been converted from Pakistani Rupees (PRs) to U.S. dollars at the rate of PRs 4.7=US$1.00.

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Table 1.—Pakistan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1967	1968	1969 [p]
METALS				
Aluminum, bauxite, gross weight		271	890	• 3,000
Antimony, mine output, metal content •		117	84	NA
Chromium, chromite, gross weight		26,378	26,021	• 26,000
Iron and steel:				
Iron ore		325	76	NA
Steel ingots and castings		• 90,000	• 100,000	• 100,000
NONMETALS				
Barite		6,301	10,356	NA
Cement, hydraulic	thousand tons	2,038	2,437	2,699
Chalk		816	565	NA
Clays:				
Bentonite		33	439	NA
Fire clay		18,262	21,204	• 16,000
Fuller's earth		22,575	21,204	NA
Kaolin (china clay)		2,939	3,082	• 3,000
Fertilizer materials, manufactured:				
Nitrogenous, gross weight [2]		207,859	188,934	293,637
Nitrogenous, nitrogen content [2]		85,241	76,219	124,712
Phosphatic, gross weight		5,265	18,834	22,348
Gypsum, crude	thousand tons	102	46	136
Magnesite, crude		2,042	1,631	NA
Natron, manufactured (soda ash)		42,958	41,286	48,282
Pigments, natural mineral, ochers		1,139	338	• 800
Quartz and related materials, silica sand	thousand tons	61	151	• 110
Salt:				
Rock	thousand tons	245	327	564
Marine, evaporated	do	446	571	573
Total	do	691	898	1,137
Stone, sand and gravel, not elsewhere specified:				
Dimension stone, calcareous, aragonite and ordinary marble		7,060	14,562	• 18,000
Crushed and broken, limestone and other calcareous	thousand tons	1,875	1,968	• 2,700
Other (use not specified), dolomite		630	12,718	NA
Strontium minerals, celestite		379	650	• 600
Talc and related materials (soapstone)		2,649	2,617	• 2,400
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades	thousand tons	r 1,340	1,274	• 1,300
Gas, natural, sales	million cubic feet	83,288	91,525	116,923
Natural gas liquids	thousand 42-gallon barrels	42	39	• 30
Petroleum:				
Crude oil	do	8,636	8,305	8,500
Refinery products:				
Gasoline	do	2,138	2,521	NA
Kerosine and jet fuel	do	4,466	5,438	NA
Distillate fuel oil	do	5,043	5,928	NA
Residual fuel oil	do	8,496	9,756	NA
Lubricants	do	387	348	NA
Other	do	1,676	1,893	NA
Refinery fuel and losses	do	1,380	1,724	NA
Total	do	23,586	27,608	NA

• Estimate. p Preliminary. r Revised. NA Not available.

[1] In addition to the commodities listed, Pakistan produces a variety of additional crude construction materials (clays, gravels, sand and stone) as well as steel semimanufactures and sulfur, but data on output are not available.

[2] Data are for urea and ammonium sulfate; ammonium nitrate is also produced, but data are not available for this commodity owing to Pakistan Government restrictions. In the year ending June 30, 1965, (latest available data) output of ammonium nitrate totaled 76,086 tons (gross weight) with a nitrogen content of 26,630 tons.

TRADE

During fiscal 1968–69,[3] Pakistan's balance of trade both in mineral commodity trade and in total commodity trade was markedly more unfavorable than in the previous fiscal year, although not as unsatisfactory as that of fiscal 1966–67. Mineral commodity exports (including reexports) in fiscal 1968–69 were valued at only about $15.6 million; mineral commodity imports had a value equivalent to $257.0 million. (Comparable figures for 1967–68 were $13.6 million and $210.4 million respectively.) Mineral commodity exports and reexports in 1968–69 constituted only 2.4 percent of

[3] July 1 to June 30.

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total commodity exports and reexports valued at $650.2 million; mineral commodity imports accounted for 25.1 percent of the total commodity import value of $1,023.1 million. (Comparable total commodity trade values for 1967–68 were as follow: Exports and reexports—$703.4 million; imports—$977.9 million.)

Among recorded mineral commodity exports and reexports, refined petroleum products accounted for over 55 percent of the 1968–69 total as shown in the following tabulation:

Commodity or commodity group	Value (million dollars) 1967–68	1968–69
Chromite	[1] 0.1	([2])
Other metallic ores	.2	([2])
Metals, including scrap	.2	.2
Cement	2.1	2.6
Fertilizer materials	2.9	2.0
Salt	.3	.6
Petroleum products	6.5	8.6
Other	1.3	1.6
Total	13.6	15.6

[1] Officially reported figure; other sources indicate a greater value.
[2] Less than $50,000.

Among mineral commodity imports, iron and steel, chiefly in the form of semimanufactures, remained the dominant category, accounting for over 48 percent of the total, followed by fertilizer materials (14 percent) and crude petroleum (13 percent), as indicated in the following summary of value of imports of major groups of mineral commodities:

Commodity or commodity group	Value (million dollars) 1967–68	1968–69
Iron and steel	78.5	124.5
Other metals, including scrap	23.3	16.2
Fertilizer materials	39.3	36.2
Coal	10.2	13.1
Crude petroleum	35.3	32.4
Refined petroleum	16.3	19.6
Other	12.5	15.0
Total	210.4	257.0

Pakistan's official trade publications do not report completely on trade in mineral commodities on a tonnage basis; quantitative data on exports are only partial and on imports, are nonexistent. Table 2, which follows, gives partial quantitive data on exports of selected commodities.

Table 2.—Pakistan: Exports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity		1967–68	1968–69
METALS			
Aluminum, metal including alloys, semimanufactures		7	4
Chromium, ores and concentrates [2]		2,529	1,100
Iron and steel, scrap		5,018	3,302
NONMETALS			
Barite		3,983	2,756
Cement, hydraulic [2] (portland only)		184,909	213,694
Fertilizer materials, nitrogenous [2] (urea only)		8,346	20,853
Gypsum		7,875	4,978
Salt		84,716	127,911
Stone, sand and gravel: [3]			
Dimension stone [2]		r 6,881	7,937
Sand		266	687
MINERAL FUELS AND RELATED MATERIALS			
Coal		450	819
Petroleum refinery products: [3]			
Gasoline	thousand 42-gallon barrels	102	103
Kerosine and jet fuel	do.	14	([4])
Distillate fuel oil	do.	134	149
Residual fuel oil [5]	do.	12,568	5,056

r Revised.
[1] Commodities listed had a total value of $13,181,893 in 1967–68 and $8,146,026 in 1968–69; these were about 96 percent and 52 percent, respectively, of total mineral commodity exports on a value basis. Quantitative data on commodities accounting for the balance of mineral commodity export value were either totally unavailable or significantly incomplete.
[2] Officially reported figures; other sources indicate considerably larger exports.
[3] In addition to commodities listed specifically, additional materials classified under these major headings were exported, but only value data are available.
[4] Less than ½ unit.
[5] Quantities given are only a part of total exports of residual fuel oil; value for tonnages reported was 76.4 percent and 39.7 percent of total recorded value for this commodity for 1967–68 and 1968–69, respectively; quantity data corresponding to remaining values are not reported, and variation in unit value for this commodity shipped to differing destinations is so large that unit value cannot be used to estimate quantities to other destinations.

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COMMODITY REVIEW

METALS

Aluminum.—Although the Governments of Pakistan and Iran concluded an agreement with Reynolds Aluminum Corp. (United States) for erection of a 50,000 ton-per-year aluminum plant at Arak, Iran in March of 1968, through yearend 1969 work had not been started on this facility. However, the joint venture project, in which Pakistan was to have a 10 percent share reportedly was still under consideration at this writing.

In an apparently unrelated development, Pakistan recorded the production of 1,936 tons of bauxite in the first 9 months of 1969, indicating a possible annual total of 3,000 tons. No details on disposition of this bauxite are available; it does not appear in official export statistics.

In October, it was reported that the Canadian Government had agreed to finance a feasibility study for an aluminum smelter in Pakistan. The raw material source, however, was not specified.

Chromite.—Despite continued advances in the world market price for chromite owing in part to restrictions on the Southern Rhodesian mine product, Pakistan's modest industry apparently showed little if any upturn in production; extrapolation of output data for the first nine months of 1969 indicates that production was virtually on a par with that of 1968.

Pakistan's chromite reserves reportedly total over 3 million tons, but the grade of this reserve is unreported.

The following data on Pakistan's chromite exports reported in official sources indicates the distribution pattern of such shipments in recent years:

	Japan	Netherlands	Poland	Total
July 1, 1966–June 30, 1967	10,300	-----	8,200	18,500
July 1, 1967–June 30, 1968	2,529	-----	------	2,529
July 1, 1968–June 30, 1969	------	1,100	------	1,100
July 1, 1969– December 31, 1969	3,300	-----	22,600	25,900

Unless additional quantities of ore were exported during 1967, 1968, and 1969, and were not recorded in official export data, an appreciable stock of chromite is apparently available in Pakistan. There were public press reports in Karachi in September indicating that such stocks did exist and that they totaled on the order of 30,000 tons. These reports indicated that the stocks would be exported to Czechoslovakia and North Korea, but other sources indicated that the bulk of this stock had already been contracted for export to a United States firm.

Iron and Steel.—Available reports indicated that the 1.2-million-ton ingot steel production target for the final year (1970) of Pakistan's third 5-year plan would be deferred to some point in the fourth 5-year plan or beyond.

A feasibility study for a 1-million-ton-per-year steel mill at Kalabagh, West Pakistan was released by a Soviet Government study group shortly after mid-year. Results of the study were unfavorable for erection of such a facility, chiefly owing to the low (33 percent) iron content of the Kalabagh ore, which was to be used for at least a part of the furnace charge. The Soviet report suggested as an alternative that Pakistani authorities examine the possibility of a coastal plant on the Arabic Sea near Karachi to utilize imported ore and coke. Near yearend, an agreement was signed between the Soviet Union and Pakistan for a study of this proposal to be conducted by Soviet technicians. Similiar studies have been conducted by several groups in the past, but none reached fruition. The most recent study was conducted by International Construction Company of London, and postulated a 500,000-ton-per-year mill at a cost of about $550 million. Subsequent to the release of this report in early 1969, it was suggested to Pakistani authorities that a smaller facility than that proposed by the British consultants, specifically one of 160,000 tons per year, might prove economically sound and easier to finance if it were to employ the Hojalata Y Lamina (HYL) process which uses natural gas as a reductant for steelmaking, a process not considered by the original consultants.

In East Pakistan, there were indications

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that the 150,000-ton-per-year Chittagong plant was not operating economically. Plans were announced in February 1969 for erection of a second plant, with an annual capacity of 500,000 tons and for expansion of the existing plant to 250,000 tons per year. Though yearend, however, there were no reports indicating efforts to finance these ventures, much less to initiate construction.

Uranium.—In late 1969, it was announced by the Chairman of Pakistan's Atomic Energy Commission that a team of uranium mining specialists from Czechoslovakia were expected in Pakistan in the near future to study and prepare a feasibility report on the mining of uranium in the Dera Ghazikhan area. It was also indicated that further efforts might be made to arrange formal bilateral agreements between Pakistan and Poland in the field of atomic energy development.

NONMETALS

Barite.—No data was available on performance of Pakistan's modest barite industry in 1969, except that the 2,756 ton export for the fiscal year ending June 30 was only about 70 percent of that recorded for the previous fiscal year. The exported product was marketed chiefly in the Persian Gulf area, with small shipments to each of several countries.

National barite reserves, chiefly at Gangao, near Khuzdar in Kalat District, and in the southern part of Hazara District reportedly total nearly 2 million tons.

Cement.—West Pakistan's nine cement plants, with a combined annual capacity of over 2.8 million tons, produced 2,636,000 tons of cement in 1969, or 97.7 percent of the national total. The balance of output was derived from facilities in the country's East Wing where one plant, at Sylhet, operating on domestic limestone was evidently in production throughout the year, but operated at only 42 percent of its 150,000-ton-annual capacity. The clinker grinding plant of East Pakistan Industrial Development Corp. (EPIDC) reportedly under construction at Chittagong in the East Wing in 1968 and scheduled for completion by the end of that year was not finished by the target date but was rescheduled to come on stream in late 1969.

In October, it was announced that preliminary approval had been granted by the Executive Committee of the National Economic Council for development by EPIDC of a limestone mine and associated cement plant in East Pakistan. The mine, at Jaipurhat in Bogra District, and the 600,000-ton-per-year plant, are to cost about $70 million. EPIDC reportedly was seeking a foreign equity partner for the venture.

Fertilizer Materials.—Pakistan's manufactured fertilizer industry showed substantial output gains in 1969, but in the case of nitrogenous fertilizers, production remained considerably below capacity. Urea production in 1969 was only 77.3 percent of the 318,000-ton 1968 rated yearend capacity; ammonium sulfate output was equal to only 55.5 percent of the 86,000-ton 1968 rated capacity. Additional nitrogenous facilities planned or underway, with completion scheduled by yearend 1970, included six new plants and additions to some of the five existing plants. If all are completed, annual urea capacity would reach over 2 million tons, and annual ammonium sulfate capacity would reach about 700,000 tons. (In addition, annual ammonium nitrate capacity would total about 105,000 tons; production of this commodity is not reported.)

In superphosphate production, national output topped 1968 rated capacity in 1969, but it is unclear whether this was due to completion of the new 150,000-ton-per-year facility in West Pakistan or to a particularly successful year of operation of the existing 18,000-ton nominal capacity plant in that area. Two 120,000-ton-per-year triple superphosphate plants scheduled for East Pakistan did not come into production during the year.

As a result of 1968 exploration efforts directed toward potassium chloride-containing brines in the Dhariala area, about 200 kilometers south of Rawalpindi, it was announced that a proposal had been advanced for establishment of a potash fertilizer plant with an annual capacity of 17,500 tons of potash fertilizer, with a completion target in 1970. The exploration project was carried out for the West Pakistan Industrial Development Corp. (WPIDC), with assistance of Rumanian technicians.

Gypsum.—Through yearend 1969, efforts to induce use of gypsum as a soil conditioner for saline soils in the Indus River

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Basin were reportedly unsuccessful despite apparent success of a test project conducted in late 1967 by the West Pakistan Department of Agriculture with assistance from the U.S. Agency for International Development. The upturn in gypsum production in 1969 was attributed to increased requirements of the fertilizer industry (for the production of ammonium sulfate) and the nation's cement industry. Over 90 percent of natural output reportedly originates from the quarry of WPIDC at Daudkhel in Mianwali District.

Salt.—Output of solar salt edged slightly upward in 1969 from the previous record high output established in 1968; for rock salt, an increase of 237,000 tons was recorded. WPIDC is responsible for the nation's entire rock salt output, which originates from six mines located at Khewra (Jhelum District), Warha (Sargoda District), Kalabagh (Mianwali District), Jatta, Bahadurkhel and Karak (Kohat District). These properties were acquired by the corporation in 1962 and underwent an expansion and modernization program during 1964–68 in an effort to pace the increased domestic demand for salt, which reportedly aggregated 75 percent during the 7-year period ending in 1969.

In December, it was reported that representatives of the firm, Brown and Root, were in Karachi engaged in discussions regarding a feasibility report on solution mining of rock salt in Pakistan. By yearend, however, the final report had not been released.

Sulfur.—Sui Gas Transmission Company (SGTC) arranged for Pintsch Bamag, a West German firm to install a sulfur recovery pilot plant at its Sui gasfield to investigate the possibility of economic recovery of sulfur. The existing gas purification plant extracts about 1.3 cubic feet of hydrogen sulfide and 70 cubic feet of carbon dioxide from 1,000 feet of feedstock. This low sulfur content and particularly the low ratio of hydrogen sulfide to carbon dioxide in the waste from the gas plant were said to present the major problem to economic recovery of sulfur; it was hoped that the West German pilot plant would overcome the problem.

In an unrelated development, it was reported in May that an elemental sulfur deposit had been found in the Sibi District, Quetta Division, of West Pakistan. No further details were available. One other elemental sulfur deposit is known in the country, the undeveloped Koh-i-Sultan deposit, near the Afghanistan border in the extreme west area of West Pakistan.

MINERAL FUELS

Energy consumption in Pakistan in 1969 was estimated to have reached about 11.7 millions tons of standard coal equivalent (SCE), excluding any estimates for the SCE equivalent of fuelwood and animal dung used as fuel. Although detailed statistics are not available for 1969 showing the sources of the energy consumed, available data suggest that once again natural gas accounted for an increasing share of the total. In 1968, the latest year for which a breakdown of energy consumption by source is available, coal provided 18.1 percent, oil 54.3 percent, natural gas 25.5 percent, and hydroelectric power 2.1 percent of a total 11.2 million tons SCE.

Coal.—Despite efforts to improve production economics and product salability, Pakistan's coal output continued to fall short of planned targets through 1969 because of a lack of market growth for indigenously produced material. Investment in collieries owned by WPIDC has been sizable and has resulted in substantial reductions in mining costs and in an increase in percentage recovery of coal in place. These collieries produce about 40 percent of the national total.

In addition to mine improvements, a briqueting plant has been erected in Quetta, and a second such plant is planned at Makerwal in an effort to produce a more desirable product. Plans have also been announced for erection of a low-temperature carbonization plant at Quetta, but through yearend, work had not been started.

There was no report on progress, if any, in developing the deep-lying (3,900 feet) Gondwana coal seams of the Rajshahi area of East Pakistan, where plans called for production to commence sometime after 1970 from reserves of 500 million to 1,000 million tons.

Natural Gas.—During 1969, Pakistan's output of natural gas, derived from six gasfields and one oilfield increased nearly 28 percent over the 1968 level. The roster of producing fields was unchanged from that

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of the previous year, but the share of total accounted for by each field shifted, as indicated in the following tabulation, which compares the fields' 1968 performance with that of 1969:

Field	Output (million cubic feet)	
	1968	1969
East Pakistan:		
Chhatak	697	710
Habiganj	476	4,412
Titas	809	
Sylhet	5,934	5,636
West Pakistan:		
Dhulian (oilfield)	5,736	6,239
Mari	1,324	9,186
Sui	76,549	90,740
Total	91,525	116,923

Of the fields listed above, those in East Pakistan had an aggregate reserve of 3.8 million million cubic feet (Titas—2.25, Habiganj—1.28, Sylhet—0.28, and Chhatak —0.02); those in West Pakistan had reserves totaling 12.0 million million cubic feet (Sui—6.28, Mari—3.94, and Dhulian—1.70). In addition to these reserves in operating fields, East Pakistan has an additional 1.66 million million cubic feet in Rasidpur and Kailas Tila fields (neither yet in operation) and West Pakistan has an additional 3.85 million million cubic feet in the as yet shut-in Uch, Khairpur, Khandhkot, Zin, Sari Singh, and Mazarani fields, giving a national aggregate of 21.26 million million cubic feet, with reserve estimates not included for the Jaldi and Bakhrabad fields in East Pakistan.

During the latter part of the year, a Japanese trade journal, reporting on a visit by Japanese natural gas specialists to Pakistan, indicated that Japanese markets for liquified natural gas would expand appreciably, and that export of Pakistani gas to this market appeared quite possible from both the technical and economic viewpoint. Although no formal action was underway in this connection, the impact of such an arrangement on Pakistan's unfavorable mineral commodity trade balance situation could be appreciable.

Despite the fact that the Pakistani Government imposed an excise duty on natural gas under its 1969–70 budget, this fuel remained by far the cheapest available on the Karachi market. Considering industrial fuels, Sui gas, with a price of Rs0.422 per therm (8.9 cents per therm) effectively used, cost only 61 percent of the residual fuel oil price and less than 48 percent of the imported coal price. For home fuels, Sui gas, with a price of Rs1.093 per therm (23 cents per therm) cost 47 percent of the Karachi kerosine price, 24 percent of the charcoal price and 17 percent of the firewood price. Further shifts toward gas use, however, must await construction of additional delivery capacity.

In mid-August, Sui Gas Transmission Company (SGTC) announced that its pipeline to Karachi reached maximum capacity of 140 million cubic feet daily, and that plans to expand capacity were being developed. Meanwhile, distribution companies were forced to begin load shedding.

SGTC was processing about 240 million cubic feet of gas daily in its purification plant at Sui field to supply its own requirements for the lines south from Sui field as well as those of the Sui Northern Gas Pipelines Ltd.'s lines northward from Sui field. SGTC announced its intent to expand installed capacity of this plant by 70 percent to 500 million cubic feet daily. Completion of this project, financed insofar as foreign exchange requirements by a $3,990,000 loan from the Pakistan Industrial Credit and Investment Corp., is scheduled for mid-1971.

Plans were also announced for a major expansion of the natural gas pipeline system in northern West Pakistan. Sui Northern Gas Pipelines Ltd. proposed requesting a $17 million loan from the World Bank to provide the bulk of the financing for the project, which would make gas available in Peshawar, Newshera, Mardan, Charsaddah, and Takht Bai by 1972. The total project would involve not only distribution lines in these areas, but also expansion of existing Sui gas transmission lines and extension of the main Sui transmission lines from Kala Shah Kaku to Gujranwala and Rahwali, as well as establishment of a transmission line from the Dhulian oilfield to Daudkhel.

Petroleum.—Crude oil production in Pakistan advanced almost 6 percent in 1969 over that of 1968, but was equal to only about 12 percent of total consumption, the balance being made up in part through crude oil imports for internal refining and in part through product imports. As in past years, Dhulain field supplied over half of total output, followed by Balkassar field with about one-third of the total, with the balance coming from the Khaur, Joya Mair, and Tut fields.

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During October, the Government of Pakistan and the U.S. firm, Oceanic Oil Exploration Company, reached an agreement in principle, under which the company will explore about 5,700 square miles in an offshore and onshore area of West Pakistan, and 9,250 square miles in East Pakistan's Ganges Delta and adjacent offshore area in the Bay of Bengal. Exact details of areas involved and terms of the agreement were not reported. Earlier, the American International Oil Co. and Wintershall A. G. of West Germany reached agreements with the Government for exploration in separate areas of West Pakistan, and field work by these firms reportedly was underway before yearend.

Exploratory drilling activities reported during 1969 involved 15 wells, nine that were underway on January 1 and six started during the year. At yearend, of this total of 15 wells, four were drilling, two were testing, two were reported plugged and abandoned, six were reported completed but results were not indicated, and one was apparently still being rigged up. The country's first offshore well, Cox's Bazaar No. 1, was unsuccessful, reaching a depth of 12,134 feet before being plugged and abandoned by Pakistan Shell Oil Co.

The nation's four existing refineries were credited with an aggregate daily crude throughout capacity of 115,000 barrels, distributed as follows: Rawalpindi refinery of Attock Oil Co. Ltd.—10,000, Karachi refinery of Pakistan Refinery Ltd.—60,000, Karachi plant of National Refinery Ltd.—12,100, Chittagong plant of Eastern Refinery Ltd.—33,000.

The Chittagong refinery, the only such facility in East Pakistan, began the year with increased crude oil receipts over the 1968 levels, but in a short time built up an overstock of products, taxing storage facilities. The plant was shut down in April to permit depletion of the overstock, which was due to the excessive production of the first 3 months, not to a reduction in consumption level following imposition of martial law as was claimed in some quarters. Refining was resumed after a 10-day period, but operations were at the level of about 20,000 barrels daily, not at the 25,000 barrel-daily-plus level of January to March.

Excess stocks at Chittagong were further depleted in June owing to a failure of the crude oil pipeline from the offshore unloading terminal to the refinery, and an attendant reduction in refinery output as recourse was made to crude delivery by lighters. As a result, the crude oil supply was reduced to no more than about 14,000 barrels of crude daily until the pipeline was repaired.

During September, there were indications of Governmental interest in the establishment of a fourth refinery in West Pakistan, with the city of Multan as the most likely site for the 40,000 barrel-per-day installation proposed. Through yearend, however, there was no indication of positive action regarding such a venture.

Total product consumption was reported as follows for 1969 in thousand metric tons: Aviation gasoline and jet fuel—386.6, motor gasoline—329.4, kerosine—746.8, distillate fuel oil—1,093.9, residual fuel oil—1,373.7, lubricants—102.9, bitumen—99.9, and other products—87.0.

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The Mineral Industry of Peru

By Frank E. Noe [1]

The first full year in office of the military government, which assumed power in Peru in October 1968, was characterized by a continued lack of buoyancy which produced a general consensus that development of the economy during the year was not particularly satisfactory. According to preliminary estimates, the gross national product (GNP) increased about 1.7 percent. This was only slightly above the 1.3 percent increase in 1968 but considerably below the 5.5-percent average for the 5-year period 1963–67. Economic developments during the year, however, should not be evaluated as isolated events but should be considered as a continuation of the contraction of the national economy which began with devaluation in 1967, increased with the expropriation of the La Brea y Pariñas oilfield of the International Petroleum Co. (IPC) in 1968, and was influenced during 1969 by extensive government programs for remodeling the Peruvian economy; these programs abetted the feeling of uncertainty in the business community, both national and foreign, and thereby tended to reduce the pace of capital spending. Private investment, affected by the uncertain economic horizon, declined in 1968 by 15 percent, while public investment fell by about 34 percent due to budget restraints imposed as part of the stabilization program. This effectively reduced the level of gross domestic investment from 25.9 percent of the GNP in 1967 to 20.5 percent in 1968. Estimates for 1969 indicated a further decrease in gross domestic investment to about 18.7 percent of projected GNP, the lowest ratio of the decade.

Favorable developments in the Peruvian economy during the year included a significant increase in the foreign exchange reserves and improvement in the foreign trade balance. The Government took positive action to refinance the nation's foreign debt, and at the same time was successful in reducing the rate of inflation in the country.

Mining accounted for 6.1 percent of the total GNP in 1968, and only a small increase was expected for 1969. According to the Mining and Petroleum Society of Peru, the value of mineral production increased about 2.8 percent during the year, an amount which was principally attributable to higher metal prices with the exception of silver. Production volume of metals and minerals was lower in 1969 primarily because of strikes at the mines and smelters of the two major mining companies.

In October 1968, the military government expropriated the La Brea y Pariñas oilfield operated by IPC. On December 31 of the same year, the government passed the "Co-active" Law No. 17353 which demands that a debt to the State be paid before the plaintiff can appeal to a higher court against the debt. (Co-active authority consists of the right, granted by law, to State entities to use forceful attachment procedures for the collection of outstanding debts). In a speech on February 6, 1969, President Velasco claimed that IPC owed Peru over US$690 million for the value of petroleum exploited from the La Brea y Pariñas oilfield since 1924 without legal title. The marketing and distribution network of IPC and its 50-percent interest in the "Lima concessions" oilfield, neither of which originally entered the dispute, were taken over by the Government through the State oil company under embargo from the courts until the US$690 million debt was paid. They are additionally under embargo for a US$15 million debt the State oil company claims against IPC for nonpayment for gasoline delivered to IPC from the expropriated Talara refinery between October 1968 and January 1969. The "Co-active" Law empowers the courts to order the seizing of a property and its auction, appar-

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ently within 45 days, unless the debt is paid. Inasmuch as IPC could not exercise its legal rights unless it deposited the US$690 million beforehand, the company instituted a series of administrative appeals at various levels of the Government, culminating with an appeal to the President for rejection of the demand for the US$690 million. The President's decision came in a ministerial resolution published on August 6 which, as had been commonly expected, denied IPC's appeal on all counts and stated basically that IPC had never been the legal owners of the company's principal oilfields, La Brea y Pariñas, and that therefore the company owed the State for all the oil taken out of the fields over the years. The resolution did not deny that the company had operated all this time in good faith and with concurrence of previous governments but states that this argument is irrelevant to the basic one of ownership. In the Independence Day speech of the President, he referred directly to the IPC "problem" as having been passed on from one government to the next over many years and that the military government had taken effective action so that "the International Petroleum Co. has disappeared from the country" and nothing would change that situation. The application of the Hickenlooper Amendment has been deferred on the basis that meaningful talks will occasionally be held for as long as is necessary for agreement between the Department of State and the Peruvian Government.

On August 25, a contract for the exploitation of the Madrigal copper-lead-zinc-silver mine in the Province of Cailloma, Department of Arequipa, was signed by the Peruvian Government and the Cía. Minera del Madrigal under Article 56 of the Mining Code, after hard negotiations for over a year. Article 56 allows for special tax benefits during recovery of the investment. For an estimated 5 years, Madrigal will pay 40-percent tax on income or no less than they would pay in the United States. After the recovery period, taxes increase to the rate current at the time of signing or approximately 54 percent. This was the first mining investment contract of importance made in the country since the advent of the revolutionary government. The Cía Minera del Madrigal is a limited partnership with Cía. Madrigal as general partner and members of the Eastern Andes Syndicate as limited partners. Cía. Madrigal is a wholly owned subsidiary of Homestake Mining Co. of San Francisco, Calif., which is also a partner in the Eastern Andes Syndicate. Investment in the development has been reported at US$10 million over the 10 months following the signing of the contract. The project is to be financed with a capital of US$760,000 from Cía. Madrigal and the balance in loans from Japanese firms; presumably these will be against future shipments of ore and guaranteed by Homestake.

To accelerate the development of mineral deposits, the Government decreed on September 2 that all companies holding unexploited concessions as of June 1965 must present a schedule of operations by December 31, 1969, to develop such concessions and begin operations by April of 1970 or risk the loss of their concessions. At the same time, the Government established a special mining fund in the Mining Bank of Peru to aid the development of small mining enterprises. Further details of these laws are described in subsequent paragraphs.

After a year of difficult negotiations, a contract was signed between the Government of Peru and the Southern Peru Copper Corp. (SPCC) providing for the development of the Cuajone ore body under Article 56 of the Mining Code and requirements of the above law pertaining to undeveloped mining properties. Project costs were estimated in mid-1969 at $355 million excluding the cost of a copper refinery for which permission had been requested but had not been granted at yearend. Completion of the project in a 6½-year period was contingent on Southern Peru's success in arranging the necessary financing. Additional details of the contract pertaining to the deposit are given in the Commodity Review section of this chapter.

No other mining contracts were signed by the military government in 1969 despite year long negotiations by various companies wishing to invest more than US$600 million in the development of Peruvian deposits of iron ore, copper, and phosphates.

Some of the laws and decrees affecting the mineral industry which were passed during 1969 follow.

Decree Law No. 17440, February 18, declares that the industrialization and commercialization of petroleum, analogous hy-

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drocarbons and byproducts, as well as basic petrochemicals, are of national interest, a public utility, and indispenable for the integral security of the State. It also states all petroleum and hydrocarbon deposits are State property "inalienable and inprescriptible." The law specifically states exploration, exploitation, refinery or distribution concessions already granted are not affected. The main points of the legislation include: Termination of the grant of petroleum concessions; the State will permit private companies to prospect, explore, exploit, or refine petroleum by contract through the Ministry of Energy and Mines or the State oil company, Petróleos del Peru (Petroperu), formerly the Empresa Petrolera Fiscal; refining and commercialization up to the main distribution points will be done by the State; the retail distribution of petroleum products will be done by nationals and granted by public bids; the exploitation of the basic petrochemical industry belongs exclusively to the State. The basic changes in the Petroleum Law (Law 11780 of 1952), created by Decree 17440, are to be incorporated into a new law which was reportedly under preparation but which had not been released by yearend.

Decree Law No. 17527, March 21, comprises the organic law for a newly created Ministry of Energy and Mines. The Ministry of Energy and Mines, established April 4 was assigned the responsibility for formulating and directing energy and mining policy, establishing related credit policies, and providing technical assistance to small and medium enterprises (whose welfare the Government has declared to be a priority). In addition it will award concessions and make contracts in accordance with special legislation related to the product concerned, aiming at optimum use of the country's potential. Agencies under the new Ministry are the Atomic Energy Committee, the Peruvian Mining Bank, the State oil company, the National Electric Services, the Santa Corporation, and the Mantaro Corporation.

Decree Law No. 17712, June 18, authorizes the Central Bank of Peru to guarantee foreign exchange to mining companies according to terms established in the respective contracts and pursuant to certain limitations contained within the law. The implementing regulations for this Decree Law were established in Supreme Decree No. 102–69–EF, promulgated July 11.

Decree Law No. 17791, September 2, provides a variety of incentives, particularly for small and medium mines. It establishes a mining investment fund in the Mining Bank to be used to finance prospecting, exploration, investment in specific mining projects, cooperatives, credit and technical assistance to small miners, and mining development in general. The Law also provides incentives for reinvestment of mining profits, guarantees of existing tax rates, and unsecured credit for mineral exploration. However, when the State assumes a part of the risk in exploration projects, it will also directly participate in any resulting exploitation.

Decree Law No. 17792, September 2, states that holders of concessions in effect as of June 18, 1965, which are not being worked sufficiently (except such small mines as specifically defined in Decree 17791) must present to the Ministry of Mines by December 31, 1969, a schedule of operations necessary to begin production, including drawings, work, acquisitions, and investments, specifying dates for each step in the project, with exploitation to begin not later than in 5 years. If the mining office does not make objections to the schedule of operations by February 15, 1970, the schedule will be considered approved; if objections are made, the concessionaire will have until March 15, 1970, to present a revised schedule which would be considered approved unless the mining office made further objections within 15 days. Scheduled operations towards exploitation were to begin by April 1, 1970 (or May 2, if a revised schedule had been required), and periodic reports on work projects scheduled and completed must be submitted. Concessions would lapse for the following reasons: Failure to present schedules of operations mentioned above; failure to undertake scheduled work during first 5 months of the approved schedule; being 5 months behind schedule after the second year or unjustified failure to achieve minimum production within 6 months of completion of scheduled operations. Minimum production is defined as one-sixtieth of the ore reserves annually. Lapsed concessions may be exploited by the State directly, in mixed companies, through operating contracts or may be granted to new concessionaires. In contracts made under Article 56 of the

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Mining Code or for mixed companies with the State, the Government may set a different time table for putting concessions into production, but Article 56 contracts will provide for lapse of concessions if the timetables fixed in the contracts are not met.

Decreè Law No. 17793, September 2, amends Article 51 of the Mining Code, reducing the area for the grouping of metallic nonferrous concessions within one economic and administrative unit. The single article law provides that the holder of a concession may combine all concessions of the same kind that form a single economic and administrative unit, provided they are located within a circumference with a radius of 5 kilometers (previously this radius was 10 kilometers) when dealing with nonferrous minerals, and of 20 kilometers when dealing with nonmetallic substances or iron, alluvial gold, or coal.

Decree Law No. 18078, December 30, increased basic income tax rates on taxable income exceeding S/50 million. The maximum rate had been 35 percent on all amounts exceeding S/500,001. The new maximum is now 55 percent on S/1,000,000,001 or more. In addition to the foregoing, there is a dividend tax which varies between 25 and 40 percent according to the residence of the stockholder, and also a tax of 30 percent on the profits after tax of foreign company branches. This means that foreign-owned mining companies that remit profits abroad will pay a maximum tax of 68.5 percent.

PRODUCTION

Although data pertaining to nonmetallic mineral production in 1969 had not become available by mid-1970, preliminary production figures indicated that the value of minerals produced during the year increased almost 10 percent over that for 1968. Volume of production of refined metals and blister copper declined about 10 percent due to strikes at the smelters of Cerro de Pasco Corp. and Southern Peru Copper Corp. However, increased production of metal in concentrates plus increased world prices for all metals but silver combined for new record high production value. Molybdenum production dropped sharply due to a marked change in the mineralogical characteristics of the ore in the Toquepala pit of Southern Peru Copper. Production of tungsten increased sharply as a result of improved production from the San Cristobal and Morococha mines of Cerro de Pasco.

Production figures for metals in Peru essentially represent a calculated recoverable content. In calculating recoverable metals, the Statistical Section of the Mining Department of the Ministry of Energy and Mines reportedly has deducted from the assayed metal content of the ores and concentrates 5 percent for copper and lead; 10 percent for zinc, iron, manganese, molybdenum, and tungsten; and 35 percent for arsenic, bismuth, cadmium, and tin. These deductions were based on average recoverability experience.

Table I.—Peru: Production of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Antimony:			
Mine output, metal content	742	786	856
Metal	325	352	364
Arsenic, white	270	1,227	481
Bismuth:			
Mine output, metal content	810	809	689
Metal	774	792	652
Cadmium:			
Mine output, metal content	444	450	334
Metal	151	172	168
Copper:			
Mine output, metal content	r 192,688	212,537	206,144
Copper sulfate	660	728	723
Metal:			
Blister	r 125,549	147,624	134,302
Refined	r 35,613	38,500	34,465
Gold:			
Mine output, metal content, troy ounces	r 82,004	105,118	127,722
Metal, do	r 53,305	65,780	74,620

See footnotes at end of table.

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Table 1.—Peru: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
METALS—Continued				
Indium, metal	kilograms	-------	312	997
Iron and steel:				
Iron ore and concentrate	thousand tons	8,586	9,015	9,620
Pig iron (excluding blast furnace ferroalloys)	do	31	111	176
Steel, ingot and casting	do	80	106	192
Lead:				
Mine output, metal content		r 159,716	154,524	162,923
Metal		r 81,818	86,421	77,923
Manganese:				
Ore and concentrate, gross weight		r 1,165	7,153	7,277
Metal content		r 489	2,432	2,656
Mercury, metal	76-pound flasks	8,135	3,022	3,366
Molybdenum, mine output, metal content		r 934	805	246
Selenium, metal	kilograms	4,810	5,766	6,841
Silver:				
Mine output, metal content	thousand troy ounces	32,107	36,362	34,147
Metal	do	r 19,898	21,363	19,436
Tellurium, metal	kilograms	14,828	24,043	17,287
Thallium, metal	do	50	-------	-------
Tin, mine output, metal content	long tons	65	99	82
Tungsten, mine output, metal content		r 410	581	672
Zinc:				
Mine output, metal content		304,799	291,404	314,752
Metal, refined		r 61,659	65,788	62,277
NONMETALS				
Barite		r 186,600	33,906	148,884
Cement, hydraulic	thousand metric tons	r 1,088	r 1,109	NA
Clays:				
Bentonite		r 2,852	12,817	25,969
Fireclay		r 7,256	6,685	7,021
Kaolin		-------	1,024	NA
Common		r 302,266	121,448	184,273
Diatomite		r 3,668	3,022	21,257
Feldspar		2,500	1,889	1,035
Gypsum:				
Crude		r 50,255	35,684	45,495
Calcined		r 41,256	29,957	NA
Lime		NA	7,659	NA
Phosphate, guano		r 64,189	77,010	20,112
Salt, all types		r 213,514	172,307	165,819
Stone:				
Dimension, marble [1]		r 14,250	14,382	NA
Crushed and broken:				
Dolomite		4,800	5,999	NA
Gravel and sand	thousand tons	r 2,025	1,406	3,140
Limestone	do	r 2,140	1,567	1,544
Silica		r 60,688	61,310	35,358
Talc and related materials, pyrophyllite		r 5,542	6,046	7,746
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Anthracite		r 12,580	7,491	12,950
Bituminous		r 154,260	153,115	154,181
Coke, all types		r 34,835	41,727	47,716
Gas, natural, gross production	million cubic feet	56,904	75,792	74,452
Natural gas liquids	thousand 42-gallon barrels	1,095	r 987	987
Petroleum:				
Crude	do	25,857	27,056	26,329
Refinery products:				
Aviation gasoline	do	34	27	30
Motor gasoline	do	7,294	9,613	9,744
Jet fuel	do	1,175	1,322	1,420
Kerosine	do	3,620	3,886	3,792
Distillate fuel oil	do	5,638	6,695	6,823
Residual fuel oil	do	6,154	8,162	7,766
Liquefied petroleum gas	do	-------	233	272
Lubricants	do	76	64	65
Asphalt	do	192	161	215
Other	do	295	93	336

p Preliminary. r Revised. NA Not available.
[1] Includes ground marble.

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TRADE

Copper became the most valuable Peruvian export for the first time, in 1969, in spite of a 3-percent drop in tonnage. The red metal alone accounted for 30 percent of the value of all Peruvian exports and for slightly over 54 percent of the total mineral export value. The five minerals listed in the table of selected mineral exports below constituted about 96 percent of the value of minerals exported. In 1969, mineral commodities represented 55 percent of the value of all Peruvian exports as compared with 52 percent in 1968. The United States, Japan, and West Germany represent the major mineral markets for Peru.

Table 2.—Peru: Selected mineral products exported (f.o.b.)

Mineral product (fine content)	1967 [1]		1968 [1]		1969 [2]	
	Quantity, (metric tons)	Value (millions)	Quantity, (metric tons)	Value (millions)	Quantity, (metric tons)	Value (millions)
Copper	196,823	$198	206,531	$234	200,523	$259
Silver	957	42	1,033	69	1,065	58
Iron ore	5,414,441	62	5,450,126	63	5,847,214	66
Lead	150,511	30	153,603	29	156,157	35
Zinc	301,388	36	303,788	83	310,843	39

[1] Ministerio de Economia y Finanzas, Dirección General de Aduanas, Lima, Peru. Estadística del Comercio Exterior, 1968.
[2] U.S. Embassy, Lima, Peru. State Dept. Airgram A-044, Feb. 19, 1970, 1 p., 2 encl., 4 pp.

Because of the satisfactory levels maintained throughout the year in the international price for most of Peru's export products, foreign sales were again at the record US$866 million scored in 1968. In contrast with these results, imports remained on the same downward trend that had characterized them in 1968 though to a far lesser extent. Due to the movements in exports and imports, by the end of 1969 the country's balance of trade showed a surplus of US$265 million, an unprecedented record in the history of Peruvian trade. The destination of Peruvian export trade has undergone sharp changes in the short period between 1966 and 1969. Purchases of Peruvian products by Western Hemisphere countries have decreased from 50.8 percent to 41.8 percent; those by European countries have increased slightly from 38.5 percent to 40.1 percent, whereas those by Asia (almost entirely absorbed by Japan) have sharply risen from 10.2 percent to 17.2. During this period 1966–69, exports to the United States have decreased from 42.4 to 34.5 percent. The United States was the principal supplier of products to Peru but its share of the market has dropped from 36.7 percent in 1967 to 30.9 percent in 1969. Western Germany, Argentina, and Japan are also important suppliers with 11.4, 10.3, and 7.2 percent, respectively, of Peruvian imports in 1969.

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1967	385	757
1968	454	866
1969 [p]	476	866
Imports:		
1967	96	819
1968	74	630
1969 [p]	NA	601
Trade balance:		
1967	+289	−62
1968	+380	+236
1969	NA	+265

NA Not available. [p] Preliminary.

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Table 3.—Peru: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Antimony:			
Ore and concentrate	704	1,346	Belgium-Luxembourg 409; Netherlands 300; West Germany 245.
Metal, including alloys, all forms	196	367	Mainly to United States.
Arsenic, trioxide	33	707	Do.
Bismuth, metal, including alloys, all forms	835	807	United States 358; Belgium-Luxembourg 230.
Cadmium:			
Intermediate metallurgical products	90	71	Mainly to United States.
Metal, including alloys, all forms	155	165	United States 85; Netherlands 37.
Copper:			
Ore and concentrate	123,563	107,842	Japan 73,317; United States 14,349.
Matte and cement	765	290	Mainly to West Germany.
Metal, including alloys:			
Blister	130,875	144,937	United States 87,366; Belgium-Luxembourg 24,875.
Refined	36,003	33,905	United States 24,288; Netherlands 3,761.
Semimanufactures	-------	101	Ecuador 52; Denmark 44.
Gold:			
Ore and concentrate [1] troy ounces	24,692	24,679	(2).
Metal [1] do	1,540	10,719	(2).
Iron and steel:			
Iron ore, concentrate, and pellets	8,497,147	8,532,345	Mainly to Japan.
Metal scrap	35	13,030	Mainly to Argentina.
Lead:			
Ore and concentrate	140,700	154,619	Japan 42,311; Belgium-Luxembourg 42,206; United States 35,661.
Metal, including alloys, all forms	79,762	79,134	Mainly to United States.
Manganese, ore and concentrate	192	-------	
Mercury 76-pound flasks	3,255	3,514	Mainly to Japan.
Molybdenum, ore and concentrate	1,948	1,175	West Germany 512; France 486.
Selenium, elemental kilograms	4,872	5,542	All to United States.
Silver:			
Ore and concentrate [1] thousand troy ounces	11,756	12,748	(2).
Metal, including alloys: [1]			
Refined and electrolytic do	18,124	16,845	(2).
Blister and mixed bars do	886	3,608	(2).
Tellurium, elemental kilograms	14,929	11,433	All to United States.
Tin:			
Ore and concentrate long tons	146	185	Mainly to Netherlands.
Metal, including alloys do	-------	40	Mainly to Colombia.
Tungsten, ore and concentrate	741	867	United States 404; Japan 359.
Zinc:			
Ore and concentrate	450,491	477,750	Mainly to Japan.
Metal, including alloys, all forms	65,507	56,420	United States 42,012; Brazil 9,603.
Other:			
Ash and residue containing nonferrous metal	18	65	All to Belgium-Luxembourg.
Base metals, including alloys, all forms, n.e.s.	341	-------	
NONMETALS			
Barite and witherite	67,439	86,371	All to United States.
Cement	15,860	27,966	All to Bolivia.
Clays and clay products (including all refractory brick), crude clays, n.e.s.:			
Bentonite	50	81	All to Ecuador.
Other	7	-------	
Fertilizer materials, guano	21	1,216	France 709; Belgium-Luxembourg 304.
Salt	240	221	All to Ecuador.
Stone, sand, and gravel	101	31	All to Venezuela.
MINERAL FUELS AND RELATED MATERIALS			
Gas, hydrocarbon, natural gas liquids	-------	115	All to Ecuador.
Petroleum:			
Crude thousand tons	338,984	488,987	Trinidad and Tobago 183,187; United Kingdom 137,117.
Refinery products:			
Gasoline	391	-------	
Kerosine	90	9	All to Chile.
Distillate fuel oil thousand tons	67,420	49,268	Do.
Residual fuel oil	32,155	48,261	All to Panama.
Lubricants	760	1,068	Mainly to Chile.

[1] Content in ores, concentrates, and refinery products of base metals included.
[2] Country distribution not separately reported.

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Table 4.—Peru: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite and concentrate	1,732	1,202
Oxide (alumina) and hydroxide	1,681	1,461
Metal, including alloys:		
Unwrought	3,062	3,361
Semimanufactures	1,723	1,720
Cadmium, metal, including alloys, all forms ..... kilograms	366	104
Chromium:		
Oxide and hydroxide ..... do	24,186	23,583
Metal, including alloys, all forms ..... do	433	1,749
Copper, metal, including alloys, all forms:		
Unwrought	2,818	8,615
Semimanufactures	795	641
Gold:		
Ore and concentrate ..... troy ounces	8,729	-------
Metal, unworked or partly worked ..... do	207	77
Iron and steel:		
Ore and concentrate	36	60
Metal:		
Scrap	16,334	7,114
Sponge iron, powder and shot	218	128
Ferroalloys	1,238	1,423
Semimanufactures	240,373	134,504
Lead, metal, including alloys, all forms	57	77
Magnesium, metal, including alloys, all forms ..... kilograms	4,805	8,425
Mercury ..... 76-pound flasks	36	2
Nickel, metal, including alloys, all forms	66	48
Platinum-group metals, including alloys, all forms ..... troy ounces	748	527
Selenium and tellurium ..... kilograms	384	2,503
Silver, metal, including alloys ..... troy ounces	9,645	4,212
Tin, metal, including alloys, all forms ..... long tons	203	195
Titanium, oxide	1,414	1,394
Zinc:		
Oxide	25	11
Metal, including alloys:		
Unwrought	11	5
Semimanufactures	147	129
Other:		
Ore and concentrate	r1,325	1,049
Metals, including alloys, all forms	3	1
NONMETALS		
Abrasives, natural, n.e.s	3,722	222
Asbestos	4,240	3,967
Barite and witherite	308	202
Boron materials	290	178
Cement	99,877	27,871
Chalk	2,090	843
Clays and clay products (including all refractory brick):		
Bentonite	2,307	1,280
Kaolin	3,543	2,928
Other	3,009	2,184
Diatomite and other infusorial earths	3,427	1,225
Feldspar and fluorspar	805	1,474
Fertilizer materials:		
Crude:		
Nitrogenous	1,331	1,725
Phosphatic	r6,142	6,968
Potassic	2,649	3,101
Manufactured:		
Nitrogenous	93,547	99,706
Phosphatic	1,085	54
Potassic	3,762	3,570
Other	5,665	9,667
Ammonia	32	94
Graphite, natural	68	62
Gypsum and plasters	432	509
Magnesite	3,234	1,020
Mica, all forms	166	70
Salt	2,714	2,928
Sodium and potassium compounds	3,887	3,536
Stone, sand, and gravel:		
Dimension stone	726	578
Dolomite	440	30
Gravel and crushed rock	91	90
Sand, excluding metal bearing	1,883	4,239
Quartz and quartzite	351	42
Sulfur, elemental	14,165	5,663
Talc and steatite	932	683

See footnote at end of table.

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Table 4.—Peru: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	401	172
Carbon black and gas carbon	3,182	2,921
Coal, all grades, including briquets	763	102
Coke and semicoke	11,632	10,351
Gas, hydrocarbon	53	34
Petroleum:		
Crude and partly refined	167,872	340,249
Refinery products:		
Gasoline	r316,000	270,268
Kerosine and jet fuel	46,986	12,561
Distillate fuel oil	601,163	408,522
Lubricants	r31,849	29,550
Mineral jelly and wax	14,000	13,183
Other	r548	434
Mineral tar and other coal, petroleum, or gas derived crude chemicals	r1,723	1,786

r Revised.

Source: Ministerio de Hacienda y Comercio, Superintendencia Nacional de Aduanas, and Ministerio de Economia y Finanzas, Dirección General de Aduanas, Lima, Peru. Estadística del Comercio Exterior 1967 and 1968, respectively.

COMMODITY REVIEW

METALS

Copper.—After a year of intensive negotiations, SPCC and the Peruvian Government signed a contract under which the company will invest $355 million to put the Cuajone copper concession into production within 6½ years from December 19, the date on which the contract was signed. According to the schedule of operations agreed on between the company and the Government, the company has agreed to begin construction by April 1, 1970, and to obligate $25 million by 18 months from that date. The contract also provides that during the period of recovery of investment, the company's earnings from the project will be taxed at the rate of 47.5 percent and then for a further period of 6 years at the rate of 54.5 percent, the rate in effect on the date of the contract. The company shall be free to export and sell the production of the Cuajone mine after local consumption needs are met.

Approximately $142 million will be spent within Peru, $172 million will be the basic cost of equipment and engineering studies performed outside of Peru, and $41 million of the investment will be interest during the construction period. To bring Cuajone into production will require that half of the total investment be spent in basic infrastructures—camps, water supply, construction of a railway from Cuajone to connect with the 168-kilometer railway from Toquepala to the smelter and port at Ilo, and removal of 160 million tons of overburden before reaching the orebody which will be mined by the open pit method. The construction of the railroad will require the driving of some 26 kilometers of tunnels including the longest railway tunnel in Peru. Other construction will include the installation of a concentrator to handle 30,000 tons of ore per day, a 120,000-short-ton expansion of the Ilo smelter which presently has a capacity of 144,000 tons of blister copper per year, power plants, and the enlargement of Ilo port works.

Cuajone's production is expected to be about 140,000 tons of blister copper per year and will come from reserves estimated at close to 500 million tons of 1 percent copper ore.

Although the signing of the Cuajone contract by SPCC represents the commitment of the largest single investment ever in Peruvian mining, another investment of note had been contracted 4 months earlier and with much less fanfare. On August 25, the Cía. Minera del Madrigal signed a contract under Article 56 of the Mining Code to invest US$10 million in the development of the Madrigal copper-lead-zinc-silver property in the Province of Cailloma, Department of Arequipa. The Homestake Mining Co. of San Francisco, Calif., has a controlling interest in the mining operation through its wholly owned subsidiary, Cía. Madrigal.

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The mine is reported to have 619,000 metric tons of proven ore and 434,000 tons of probable ore. The Ministry of Energy and Mines has estimated a production of 500 tons per day which will yield a calculated life of approximately 6 years. Further reserves may be developed during the operation. Calculated gross mineral content is 2.8 percent copper, 3.8 percent lead, 5.5 percent zinc, and 4.3 ounces of silver per metric ton. Underground exploration and development of the vein have been underway since before 1968. Approximately 60 percent of the investment is to be spent in the construction stage where 500 men will be employed in building a highway between the mines and Chivay, access roads, a 2,500-kilowatt powerplant, a 500-ton-per-day mineral treatment plant, an urban center, and other installations. Concentrates will be transported from Madrigal to Sumbay by truck and by the Southern Peru Railway from Sumbay to the port of Matarani for export to world markets. Annual production as projected will be 12,300 metric tons of copper concentrate, 10,000 metric tons of lead concentrate, and 12,300 metric tons of zinc concentrate, representing a total annual value of about $5.5 million.

The principal copper producer by far continued to be SPCC which owns the Toquepala open pit copper mine located in southern Peru in close proximity to the Cuajone and Quellaveco concessions. Although development has started on the Cuajone deposit, only Toquepala is currently in production. Operations at Toquepala were interrupted during the year by a 42-day illegal strike at the mine which resulted in a shutdown of the Ilo smelter for 32 days after the stock of concentrates had been exhausted. Salient statistics for SPCC operations for the years 1967–69 follow:

	1967	1968	1969
Ore and waste mined—thousand metric tons	58,940	62,431	58,939
Ore treated—do	12,297	13,056	12,297
Ore-to-waste ratio	1:3.8	1:3.8	1:3.8
Copper content of—			
Ore milled—percent	1.18	1.21	1.18
Blister produced—metric tons	126,507	134,010	126,506
Molybdenum concentrates—do	1,683	1,426	295

Cerro de Pasco Corp. maintained its position as the second largest copper producer and No. 2 taxpayer in Peru during 1969. Because of strikes in April and September, output of most refined metals and concentrates was about 10 percent below that of 1968 when there were no strikes. Significant increases were shown, however, in gold and tungsten output. A tabulation of the principal metal and mineral production of the Cerro de Pasco operation follows:

	1967	1968	1969
Copper—metric tons	37,387	53,210	47,959
Lead—do	81,651	86,346	77,539
Zinc:			
Refined—do	61,715	65,873	62,359
In concentrates—do	84,918	80,680	74,359
Bismuth—do	775	792	652
Gold—troy ounces	37,178	43,160	52,000
Silver—thousand troy ounces	19,507	20,371	18,532

The twin-adit Graton tunnel project, begun in 1961 to drain and ventilate the lower levels of the Casapalca mine, was completed in 1969, with the targeted distance of 11.36 kilometers reached in November. Subsequent drilling induced waterflows through the tunnels which have lowered the water level in the previously flooded section by more than 300 feet. Cerro de Pasco responded to Decree Law No. 17792 which called for submission of plans and schedules of investment for placing into production all exploitation concessions held since June of 1965 and which were not yet being mined by submitting the required schedule of operations for four properties: Antamina, Chalcobamba, Ferrobamba, and Tintaya.

Antamina is about 100 miles northwest of the town of Cerro de Pasco, and previous

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work has disclosed a sulfide deposit for which 5.8 million tons, averaging 2.6 percent copper and 1.3 percent zinc and 0.75 ounces of silver per ton, are estimated on the basis of underground workings and core drillings. The Chalcobamba property is southwest of Cuzco in southern Peru, and core drilling and surface mapping have indicated 27.8 million tons of sulfide mineralization averaging 2.1 percent copper. Ferrobamba is adjacent to Chalcobamba and has a potential based on samplings of old workings and outcrops of 1.75 million tons of mineralization with an approximate grade of 3.4 percent copper and 0.7 ounce of silver per ton. Tintaya, also in southern Peru, is a deposit of oxide mineralization estimated at 7 million tons, averaging 3 percent copper.

In addition to the above, companies required to file schedules of operations for development of copper projects include SPCC for its Quellaveco deposit containing an estimated 200 million tons of 0.95 percent copper; American Smelting and Refining Co. for its Michiquillay deposit of 590 million tons of 0.75 percent copper; Andes del Peru, a subsidiary of The Anaconda Co. with its Cerro Verde deposit of an estimated 180 million tons containing 1 percent copper; and Cía. de Minerales Santander, a subsidiary of St. Joseph Lead Co., for its Hualgayoc copper deposit in the Department of Cajamarca, of unspecified tonnage and grade. It has been estimated that it would require well over one-half billion dollars to bring the above projects into production.

Early in April, the Mitsui Mining and Smelting Co., in conjunction with Nippon Mining Co. Ltd., inaugurated a concentration plant at Minas de Cobre de Chapi, S.A., 60 miles south of Arequipa. An investment of over $5 million was used for reopening an old producer and installing of flotation equipment to produce copper concentrates for export to Japan. The reported capacity of the plant is 800 tons of ore per day, which is expected to yield 2,000 tons per month of concentrates.

The Cía. Minera Condestable, S.A., also owned jointly by Nippon Mining and Mitsui Mining, was established in 1963 as the the first Japanese mining company to operate in Peru. In 1969, the company produced 12,400 tons of copper concentrates averaging 25 percent copper content from its Condestable mine located 94 kilometers south of Lima. All production was exported to Japan. At yearend the company was increasing the capacity of the concentrating plant to 600 tons per day.

Operations at the Quiruvilca mine of the Northern Peru Mining Corp., a wholly owned subsidiary of American Smelting and Refining Company, continued at full capacity during 1969. The concentrator produced 21,417 tons of copper concentrates, 2,059 tons of lead concentrates, and 7,284 tons of zinc concentrates. These concentrates also contained 1,009,568 ounces of silver. Copper precipitated from mine drainage water amounted to 685 tons.

Iron Ore.—Early in the year, the Marcona Mining Co. announced that it planned to invest $25 million to increase its annual production of iron ore products to 10.5 million tons of iron ore, concentrate, and pellets. Negotiations toward an agreement which would permit completion of the expansion program were still under way at the end of the year.

Production of iron ore by Marcona Mining Co. reached a new high with an output of 9,619,500 metric tons of ore and pellets during the year. The company also produced a record for 17 years of activity by shipping 9,594,580 metric tons of iron ore from the port of San Nicolas in southern Peru. This was an increase of about 602,000 tons over shipments in 1968. Of the total shipped, the quantity of pellets amounted to a new high of 3,539,739 tons which were 208,368 tons above the previous year. The principal quantity consisting of 9,339,010 tons was exported, and the remaining 255,570 tons were shipped to Chimbote for domestic consumption in Peru by Sociedad Siderúrgica de Chimbote, S.A. (SOGESA), the Government steel company. Japan, the principal market, received 7,589,610 tons while the United States, the second-ranking market, received 969,292 tons.

As reported in the 1968 Minerals Yearbook, Marcona made the first two trial shipments of iron ore in slurry form. In 1969, Marcona moved five partial cargoes of slurried iron-ore concentrate in ships, employing the Marconaflo slurry system. Of these cargoes, three originated in Peru. The Marconaflo system is a unique process of pumping bulk concentrates in a 25-percent water solution aboard ship, dewatering the concentrates before departure

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or while in transit, leaving a nonshifting cargo containing less than 8 percent water, only slightly above the water content of conventional bulk concentrate shipments. On arrival at destination, special high-pressure water jets developed by Marcona are employed in the ships' cargo holds to liquefy the cargo for pumping ashore. Marcona claims that the system reduces direct power and handling costs of loading and discharging iron-ore concentrate by as much as 90 percent from the cost of conventional ship unloading systems. Equipment required in the system has been designed and developed by Marcona, and patents and trademarks have been applied for. Early in the second half of the year, Marcona concluded a contract for delivery of more than 2 million tons of slurried iron-ore concentrate to the new Portland, Oreg., plant of Oregon Steel Mills, an affiliate of the Gilmore Steel Corp. of San Francisco, Calif.

Iron and Steel.—The Government steel company, SOGESA, achieved new highs in the output of pig iron, steel ingots, and merchant mill products. The plant consumed 265,000 tons of iron ore of which approximately 211,000 tons was in the form of pellets. Tests initiated in 1968 have definitely established the benefits to be obtained from use of 100 percent pellets in the blast furnace charge. The use of pellets has not only increased the output of pig iron but has also reduced coke consumption by 20 percent.

Lead and Zinc.—Mitsui Mining and Smelting Co. of Japan reported that its Peruvian subsidiary, Santa Luisa, S.A., will double the capacity of its zinc, lead, and copper ore treatment plant to 1,000 tons per day. Expansion work on the flotation plant was to commence before the end of the year. Current output at the mine was 500 tons per day of ore containing 12 percent zinc, 6 percent lead, and 2 percent copper. During the year the mine produced 39,600 tons of 48-percent zinc concentrates; 14,400 tons of 52-percent lead concentrates; and 3,000 tons of 20-percent copper concentrates. The lead and zinc concentrates were exported to Japan, while the small copper production was sold locally to Cerro de Pasco.

It has been reported that the Toho Zinc Co. Ltd. of Japan has taken a 1-year option on the Gran Bretaña mine, during which time the Japanese company will invest $250,000 in diamond drilling and underground work to learn more about the deposit. At the end of the year period, the Japanese concern has the option to buy into the mine for $1 million and form a company owned 70 percent by itself and 30 percent by the San Martin family (the mine's current principal owner). The Gran Bretaña mine is located in the Province of Jauja, Department of Junín, in the central region of Peru. To date, the mine has been operated as a manganese producer. About 8 years ago, however, a zinc deposit was discovered, and during the last year, the mine has occasionally produced zinc concentrates. The mine has a concentrating plant with a capacity of 250 tons per day. Its zinc concentrates are reported to contain around 60 percent zinc and some cadmium. Inasmuch as the company is indebted to the Mining Bank, the latter is now supervising the working of the mine.

The San Ignacio de Morococha, S.A., Mining Co. was scheduled to complete installation of a concentrating plant by year-end at their new San Vicente zinc mine, located in the District of Vitoc (beginning of the jungle area), Province of Tarma, Department of Junín, in central Peru. The concentrating plant will have a capacity of 700 metric tons per day and will produce between 72,000 and 75,000 metric tons of zinc concentrates (more than 60 percent zinc) per year. About 350 workers were employed during the construction stage, but this number will be reduced to about 200 to 250 workers when construction is completed. The concentrates will initially be hauled by trucks from the mine, but the company is constructing a 4-inch pipeline, 14 kilometers long, to carry the concentrates from the mine to the central highway from where they will be transported by truck to the port of Callao to be shipped to Japan at the rate of about 6,000 metric tons per month. Mining is a new venture for this section of Peru which has mainly been devoted to agriculture in the past. However, successful operation of the San Vicente mine could develop a new industry in the area inasmuch as other mineral deposits are known to exist.

Grace and Cía. had established a Peruvian subsidiary which has been developing two base metal mines in Peru for several years. Development has been satisfactory, and a 500-ton-per-day mill will be built at the Ticapampa lead-zinc-silver mine lo-

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cated north of Lima in the central highlands. The Ticapampa mine was operated until 1967 by the Anglo-French Ticapampa Silver Mining Co., Ltd., S.A. In 1967, Grace and Cía., Minera Castrovirreyna, and Cía. Minera Condor took over the old company and formed the Cía. Minera Alianza, with Grace as a minority shareholder, to explore, develop, and operate the mines of the Ticapampa District. The net result of Alianza's intensive exploration program was the development of sufficient accessible ore to warrant the expansion of the operation to around 500 tons per day. Construction of the new operation was expected to start in the latter part of the year.

MINERAL FUELS

As though to prove its good intentions and to counteract the antiprivate capital impression created by its seizure of IPC properties, the Peruvian Government in January granted offshore concessions to three of the nine companies which had applied for acreage between 7° and 16° south latitude and granted also one inland concession in the Sierra. The favored concessionaires were Occidental del Peru, Inc., Texas Petroleum Co., and the Government-owned Empresa Petrolera Fiscal. The companies were awarded 3-year exploration concessions over areas varying between 395,000 hectares and 400,000 hectares. The Peruvian Gulf Oil Co. was awarded a 5-year exploration concession covering 280,000 hectares in the Cuzco and Puno regions. All of the above concessions were applied for under the Petroleum Law, No. 11780, and were granted within the terms of that Law. These were the last concessions to be granted under 11780 as the Government, by means of Decree Law No. 17440 of February 18, prohibited the granting of any new petroleum concessions within the territory of Peru. It is considered that Decree Law No. 17440 was a hasty intermediate measure pending the issuance of a new Petroleum Code which had been under consideration by the Government since 1968. However, by yearend, although petroleum interests had seen drafts of a proposed code, the final law had not been issued.

The final act in the removal of IPC from the Peruvian petroleum scene was accomplished in August when, for an alledged debt of $690 million asserted for illegal exploitation of its concession during 44 years, the Government expropriated the remainder of IPC's property including the marketing and distribution system, real estate, and the 50-percent share in the Lima concession. Properties seized were turned over to Petroperu, the State oil company. (In July, the name of the State oil company, Empresa Petrolera Fiscal, was changed to Petroperu, an abbreviation for Petróleos del Peru.) The remaining 50-percent share in the Lima concession is held by Burmah Oil.

During the year, there were about 41 million hectares under exploration and exploitation concessions. Of this amount, 38.25 million hectares were assigned to Petroperu. About 1.6 million hectares were in eastern Peru's Amazon basin where no new development was active nor planned with the exception of the small producing fields of Ganso Azul and El Oriente. It has since been reported that late in the year, the Texas Petroleum Co. renounced all of its concessions in the eastern zone amounting to some 245,764 hectares. These were concessions held over a period of many years and on which exploration work had been done. It is understood that the company relinquished the concessions for lack of positive findings. Sixty thousand hectares in the coastal fields comprised the Lima concession which is jointly held by Burmah Oil and Petroperu. Continental Shelf concessions include 35,000 hectares under exploitation by Belco Petroleum Corp., and 800,000 hectares are the two exploration concessions on the southern Shelf granted to Occidental Petroleum Corp. and Texaco Oil Co.

There were 38 exploration wells drilled in 1969 of which 23 were offshore, 14 were in the coastal zone, and 1 was in the eastern zone. Of the offshore group, 4 were producing and 19 were abandoned. In the coastal zone, 6 were producing, and 8 were abandoned. The above drilling activity was carried out by the two big producers in Peru—Belco and Petroperu. The only other hole drilled during the year was by Mobil in its unsuccessful exploratory series in the Santiago River area of eastern Peru. The drilling rig was returned to the United States.

There were 152 development wells drilled during the year with 24 nonproducers. All of the producing wells were located in the Continental Shelf or the coastal zone. There were 7 drilling rigs actively drilling or

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testing development wells at yearend, and 723,002 feet had been drilled.

Production of crude petroleum decreased 2.7 percent below the 1968 quantity. Belco, the principal private producer, increased its production by 924,000 barrels over 1968. However, this was not enough to compensate for eight petroleum companies' production decline of 1,474,000 barrels. This decline was largely accounted for by the two oilfields formerly worked by IPC, with 614,000 fewer barrels from La Brea y Pariñas, declining field for many years, and 654,000 fewer barrels from the Lima concessions which had been holding steady except for a slight decline in 1967. Contributions to the total supply were 64 percent from the Coastal area, 32 percent from the Continental Shelf, and 4 percent from the Eastern Zone.

Table 5.—Peru: Distribution of crude petroleum production by zone and company

(Thousand 42-gallon barrels)

Zone and company	Production	
	1968	1969
CONTINENTAL SHELF		
Belco Petroleum Corp. of Peru	7,492	8,416
Petróleos del Perú	281	(1)
Total	7,773	8,416
COASTAL		
Belco Petroleum Corp. of Peru	66	41
Petróleos del Perú, Los Organos	1,553	1,574
Petróleos del Perú, Lima concession [2]	10,974	10,320
Petróleos del Perú, La Brea y Pariñas [3]	5,564	4,950
Petrolera Amotape, S.A.	14	2
Total	18,171	16,887
EASTERN		
Compañía de Petróleo "Ganso Azul", Ltda.	612	621
Compañía Peruana de Petróleos "El Oriente", S.A.	500	405
Total	1,112	1,026
Grand total	27,056	26,329

[1] Production figure included in "Los Organos."
[2] Jointly held by IPC and Burmah Oil Co. until July 1969 at which time Peruvian Government confiscated IPC's interest and assigned the operation of the property to Petroperu.
[3] IPC until October 9, 1968; Peruvian Government agencies thereafter.

Although Peru has about 2.5 trillion cubic feet of natural gas reserves, the greater part lies on the eastern slope of the Andes Mountains or in the Amazon basin and therefore far from a large potential market. Petroperu accounted for about 83 percent of all the natural gas produced in Peru in 1969. La Brea y Pariñas together with the Lima concessions produced about 72 percent of Peru's gas. Practically all production came from the coastal and offshore areas. Petroperu's plans for the future include the construction of an 812-mile-long gas pipeline between the Talara and Lima to transport 200 million cubic feet of gas per day. A tabulation of 1968–69 production and use of natural gas follows:

		1968	1969
Production of natural gas	million cubic feet	75,792	74,452
Liquefied gas	do	3,555	3,301
Used as fuel	do	13,248	13,806
Used in gas-lift	do	9,806	9,659
Returned to oilfield	do	14,594	10,415
Flared or otherwise lost	do	34,589	37,271
Utilization	percent	54.4	49.9
Flared or otherwise lost	do	45.6	50.1

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Refinery output increased slightly, with a small reduction at IPC's former refinery at Talara being more than offset by increases at Petroperu's La Pampilla refinery and the Conchan-Chevron refinery (operated and half-owned by Standard Oil Co. of California). The following tabulation of refinery runs shows production for 1968 and 1969 in thousand 42-gallon barrels.

	Motor gasoline		Kerosine		Diesel		Residual fuel		Other	
	1968	1969	1968	1969	1968	1969	1968	1969	1968	1969
Petróleos del Perú:										
Talara	6,384	6,155	3,076	2,921	5,330	5,503	4,640	4,498	1,859	1,673
La Pampilla	1,939	2,160	611	589	559	625	2,164	1,847	r 521	518
Iquitos	85	108	58	70	129	89	98	87	1	2
Refinería Conchon-Chevron, S.A	1,068	1,194	65	144	378	455	1,147	1,216	r 86	179
Cía. de Petróleo Ganso Azul, Ltda	137	127	76	68	145	151	112	118	4	1

r Revised.

Four refinery products accounted for 91 percent of the output, a slight drop of 2 percent from the 1968 production. Output of these products in million barrels were: Motor gasoline 9.7; residual fuel oil 7.8; diesel oil 6.8; and kerosine 3.8.

Petroperu's 20,000-barrel-per-day Pampilla refinery, built by the Japanese Gasoline Co., will be expanded to 30,000 barrels per day with completion scheduled for 1970. The Talara refinery is scheduled for expansion from 60,000 to 80,000 barrels per day, and construction of a new 25,000-barrel-per-day refinery at Mollendo has been projected for the near future.

Domestic consumption of petroleum products apparently has varied little compared with the previous 2 years. Preliminary figures show consumption of 9.9 million barrels of gasoline, 8 million barrels of fuel oil, 6 million barrels of diesel oil, and 3.9 million barrels of kerosine.

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The Mineral Industry of the Philippines

By Ta Li [1]

The Philippine mineral industry grew steadily during 1969, with the value of mineral output reaching an alltime high of $313.8 million, a 20-percent increase over the 1968 figure. The metallics sector, basically export-oriented, was again the leader and comprised about 72 percent of the total output value. Nonmetallics, being local-market-oriented, contributed the remaining portion. Copper continued as the leading mineral produced, although cement, chromite, gold, and iron ore were also important.

Among the major developments completed during the year was the startup of the Marcopper Mining Corp.'s Santa Cruz mine on Marinduque Island. When fully operative, the mine will reportedly be the second largest copper mine in the Far East, the first being Atlas Consolidated Mining & Development Corp.'s mine at Toledo, Cebu. Plans for the Philippines' first copper refinery were shelved because studies indicated the project would be unfeasible.

Formal announcement was made to proceed with the exploitation of the nickel laterites on the Surigao Mineral Reservation, and preparations were made for production to start by 1972. Work on the Philippines' first integrated steelworks at Iligan, Mindanao, continued on schedule. During the year, a cold-rolling mill became operative and a hot-strip mill will soon be completed. Plans call for the integrated steelworks to be completed by late 1972.

Preparation of new legislation to replace the country's basic mining code in the Mining Act of 1936 continued. During the year, two drafts of a proposed mining code were submitted to the Philippine Congress. The first, sponsored by the private sector, envisioned slight changes in some undesirable amendments but not in the basic concepts of the present law. The second, sponsored by the Bureau of Mines, in essence recommends the repeal of the present law and has provisions for such extensive changes as the requirement of a license to carry out exploration, exploitation, and processing work; the granting of such rights to only those with sufficient technical, financial, and organizational capability; and that application, not discovery, is the genesis of a mining right.

The Philippine Senate Oil Bill No. 676, introduced in 1968, was still awaiting passage in 1969. It provides for the establishment of a commission with the authority to control internal petroleum product prices, costs of imported crude oil and product prices, and amounts of petroleum imports. In addition, it would have the final authority over expansions of existing refineries, the licensing of new refineries, the setting of permissible rates of return for refiners, and the licensing of distribution outlets.

PRODUCTION

The nearly 20-percent increase in 1969 in copper output was due both to existing facility expansion at well established mines and to the development of new pits. Mercury production benefited from a new kiln added in 1969. The small amounts of lead and zinc produced were principally by-products of copper and gold mining; the zinc was from gold-zinc ores mined at Tuba on Luzon and copper-zinc ores extracted

[1] Mining engineer, Bureau of Mines, Washington, D.C.

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at Bagacay on Samar. Byproduct molybdenite was derived mainly from copper ores of the Sipalay mine on Negros.

Breakdown of mineral commodity output value showed copper ores and concentrates, valued at $168.6 million, was the most important item in 1969. Cement was second with $56.8 million, followed by gold ($30.3 million), iron ore and concentrate ($13.8 million), chromite ($8.8 million), and salt ($7.4 million). Not included in total output data were iron and steel products, which were of some significance, and petroleum refinery products, which were of considerable importance.

Table 1.—Philipines: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Cadium, mine output, metal content	3	2	------
Chromium, chromite, gross weight thousand tons	420	439	470
Copper, mine output, metal content do	85	110	131
Gold thousand troy ounces	491	527	571
Iron and steel:			
Iron ore and concentrate thousand tons	r 1,478	1,353	1,561
Ferroalloys	718	NA	850
Steel semimanufactures thousand tons	187	210	294
Lead, mine output, metal content	95	84	67
Manganese ore and concentrate, gross weight thousand tons	86	66	20
Mercury, mine output, metal content 76-pound flasks	2,611	3,544	3,478
Molybdenum, mine output, metal content	25	43	16
Silver, mine output, metal content thousand troy ounces	1,396	1,575	1,561
Zinc, mine output, metal content	1,548	2,243	3,286
NONMETALS			
Asbestos	58	32	45
Cement, hydraulic thousand tons	2,112	2,564	2,950
Feldspar	NA	42,324	35,391
Fertilizer materials:			
Crude: Phosphate rock	1	521	NA
Manufactured:			
Nitrogenous	NA	9,097	9,731
Mixed and unspecified	84,255	93,312	81,283
Gypsum and anhydrite, crude thousand tons	r 20	21	37
Lime do	84	105	216
Pyrite and pyrrhotite (including cupreous):			
Gross weight thousand tons	146	182	96
Quartz, glass sand do	311	429	638
Salt, marine do	116	217	231
Stone, sand and gravel, n.e.s:			
Crushed and broken:			
Dolomite	6,794	6,198	4,826
Limestone thousand tons	r 3,334	3,789	NA
Sulfur, elemental	24	42	32
Talc	444	872	942
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades thousand tons	65	32	53
Petroleum, refinery products:			
Gasoline, aviation and motor thousand 42-gallon barrels	12,792	13,720	14,561
Kerosine and jet fuel do	3,775	5,807	5,744
Distillate fuel oil do	9,533	11,261	12,853
Residual fuel oil do	16,500	20,586	21,337
Refinery fuel and losses do	2,913	3,721	4,271
Other, including unspecified do	1,347	1,261	1,744
Total do	46,860	56,356	60,510

p Preliminary. r Revised. NA Not available.

TRADE

Philippine mineral commodity exports consist chiefly of metalliferous ores and concentrates. Major 1969 mineral exports included copper ores and concentrates, valued at $132.6 million, compared with $113.5 million in 1968; iron ores and concentrates, $14.3 million, compared with $10.0 million in 1968; chromite ores, $9.7 million, compared with $8.3 million in 1968; mercury, $1.5 million, compared with $1.6 million in 1968. The United States was the destination of nearly half of the refractory chromite and about half of the copper production from the Lepanto mine. Virtually all the re-

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maining copper, metallurgical chromite, and iron ore were sent to Japan.

The bulk of Philippine mineral imports consists of base metals (chiefly iron and steel) and mineral fuels. In 1968, about $110 million of base metals and $106 million of mineral fuels were imported. Data for the first half of 1969 showed that imports of base metals were running about 10 percent higher, while imports of mineral fuels were at the same level as the previous year. Japan supplied over half of the base metal imports. Some two-thirds of the crude oil imports, the largest component of imported fuels, came from the Middle East, and the last third from Malaysia.

Table 2.—Philippines: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Chromium:		
Metallurgical	104,278	129,797
Refractory	478,952	294,544
Copper ore and concentrate	260,634	395,636
Iron ore and concentrate thousand tons	1,546	1,382
Manganese ore and concentrate	64,826	75,833
Mercury, 76-pound flasks	2,066	2,477
Zinc ore and concentrate	2,475	3,160

Source: Department of Commerce and Industry, Bureau of Census and Statistics, Foreign Trade Statistics of the Philippines, Manila, 1968 and 1967.

Table 3.—Philippines: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	7,252	9,076
Copper, metal, including alloys, all forms	4,567	5,168
Iron and steel:		
Scrap	6,379	11,279
Pig iron, ferroalloys, and similar materials	14,360	14,985
Steel, primary forms and semimanufactures thousand tons	454	718
Lead, metal, including alloys, all forms	4,347	4,636
Tin, metal, including alloys, all forms long tons	518	624
Zinc, metal, including alloys, all forms	16,393	16,249
NONMETALS		
Asbestos	1,780	1,837
Clays, kaolin	3,319	3,950
Diatomite and other infusorial earths	11,924	403
Fertilizer materials:		
Crude, phosphatic thousand tons	24	106
Manufactured do.	107	197
Gypsum	64,568	58,009
Sulfur, elemental, all forms	558	2,710
Talc	2,859	2,838
MINERAL FUELS AND RELATED MATERIALS		
Coke and semicoke	14,059	14,803
Petroleum:		
Crude thousand 42-gallon barrels	40,197	46,537
Refinery products:		
Gasoline do.	2,031	620
Kerosine do.	408	84
Distillate fuel oil do.	361	165
Residual fuel oil do.	591	71
Lubricants do.	719	629
Other do.	159	277
Total do.	4,269	1,846

Source: Department of Commerce and Industry, Bureau of Census and Statistics. Foreign Trade Statistics of the Philippines, Manila, 1966 and 1967.

COMMODITY REVIEW

METALS

Chromite.—The downward trend of the Philippine refractory chromite production was reversed in 1969, as production rose to 358,787 tons, about an 18-percent increase. All refractory chromite came from Consolidated Mines Inc.'s Masinloc mine in west-central Luzon. New reserves were outlined, and underground operations began in mid-1969. Output from the mine will be able to be maintained at the 350,000-ton level well into the 1970's. However, the future of the industry does not presage substantial growth, as there is an accelerating trend

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toward replacing open-hearth, chromite brick furnaces with basic oxygen furnaces requiring higher temperature refractories.

Production at the Acoje Mining Co., Inc.'s Zambales property, the country's only producer of metallurgical chromite, decreased nearly 20 percent to 110,992 tons.

Copper.—In recent years, much progress has been made toward the expansion of existing mines and exploration for and development of new mines. At yearend 1969, the country possessed reserves of over half a billion tons of disseminated copper ore grading 0.6 to 0.9 percent. In view of the planned expansions, and the present construction of new facilities, Philippine copper output should exceed the 200,000-ton level by 1972.

Thirteen of the 16 mining companies producing copper in 1969 were primary producers. Mine-copper output by major producers is shown in the following tabulation:

Company	1968	1969
Atlas Consolidated Mining and Development Corp.	42,200	51,000
Lepanto Consolidated Mining Co.	26,000	25,900
Marinduque Mining and Industrial Corp:		
Bagacay	7,800	10,400
Sipalay	15,400	18,100
Philex Mining Corp.	9,100	12,300
Total	100,500	117,700

Atlas Consolidated, the largest copper producer in the Far East, derives all production from underground and open-pit workings in Toledo, Cebu. Presently, all output from the workings is beneficiated at the Toledo mill, with the underground Lutopan mine supplying about 80 percent of the feed. However, plans were approved in September 1969 for the installation of a new 20,000-ton-per-day mill to process ore from the Biga pit, where output is being expanded. The pit's ore reserves have been increased to over 160 million tons, averaging 0.45 percent copper, by lowering the cutoff grade to 0.30 percent copper. The cost of the expansion program was estimated at $20 million, reportedly to be funded by a long-term loan from the Mitsubishi Metal Mining Co. Ltd. of Japan in return for the marketing rights. The expansion is expected to be completed by 1971. Meanwhile, a new grinding and flotation circuit was added to the Toledo mill, increasing the daily mill capacity to 27,000 tons by 1970.

A pilot plant was completed in early 1969 near the Lepanto Consolidated Mining Co.'s Mankayan mine in Luzon. Test runs for arsenic-free copper matte production were in progress. When the plant is in full operation it will save Lepanto Consolidated penalty charges on the high arsenic content of its ores.

Marinduque Mining and Industrial Corp. operates two copper mines, the Sipalay on Negros Island and the Bagacay on Samar Island. The Bagacay mine, which was hit by a destructive typhoon in 1968, returned to normal operations during the year. At the Sipalay mine, overall daily capacity was increased to 8,000 tons. Further expansion to 12,000 tons is envisioned for 1970. Capacity was also increased at the Philex Mining Corp. mine and mill at Tuba in west-central Luzon through the addition of a new 6,000-ton-per-day mill put on stream in August 1969, bringing total mill capacity to 10,000 tons per day.

Marcopper Mining Corp., a joint venture of the Philippine Government and the Placer Development, Ltd. of Canada, joined the ranks of Philippine copper producers in late 1969 with the startup of its Santa Cruz porphyry copper mine and mill. Present ore reserves at the mine are estimated at 90 million tons, averaging 0.75 percent copper. Initial annual copper production is expected to be 35,000 tons. The mine was built at a cost of $60 million, and all production for the next 10 years is under contract for delivery to Nippon Mining Co. Ltd. of Japan.

Another significant copper project, completed in March 1969, was Black Mountain Inc.'s Kennon mine and mill in Mountain Province. The mill was reportedly operating at its full capacity of 2,000 tons-per-day, and capacity was planned to be doubled within the next 3 years. About 12 million tons of 0.63 percent disseminated copper ore has been delineated and is being extracted by panel caving.

Gold.—The Philippines is among the world's top 10 producers of gold. About 60 percent of gold production is derived from primary sources, and the remainder is a byproduct of copper production. Benguet Consolidated, Inc. the largest gold producer, with its mines at Baguio in Mountain

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Province, accounted for nearly half of the 1969 total production.

Iron Ore.—The Philippine Iron Mines, Inc., the largest producer of iron ore, resumed normal operation in 1969 after a year of poor production due to the transition to pellization of all iron ore output. Output in 1969 was 735,519 tons of pellets, compared with 1968's 697,870 tons. The most dramatic growth within the industry in recent years has been in the iron sand sector. Iron sand production, from Maraveni Consolidated and FILMAG, has contributed about 30 percent of the total iron ore production since the mid-1960's. This has been caused by Japan's preference for iron sands, Japan being the only present outlet of Philippine iron ore.

Iron and Steel.—Iligan Integrated Steel Mills Inc. progressed steadily with the construction of the first Philippine integrated steelworks, located at Iligan, Mindanao. Raw materials for the steelworks will be derived from indigenous limestone and some domestic iron ore, with coke being imported. The company's present facilities include a 100,000-ton-per-year tinning line and a new 400,000-ton-per-year cold rolling mill, which was put on stream in early 1969. A 65,000-ton-per-year hot-strip mill, now under construction, will be finished in early 1970. In addition, construction on the planned 1,500-ton-per-day blast furnace and two 60-ton-per-charge oxygen furnaces will probably start in 1970 and be finished by early 1972. The completed project is planned to produce annually about 640,000 tons of crude steel and 430,000 tons of rolled products.

Mercury.—Palawan Quicksilver Mines, Inc. the only producer of mercury, operated its four rotary kilns at full capacity during 1969. A fifth kiln was added at mid-year, thereby increasing total daily furnacing capacity from 350 to 475 tons of ore. The company reportedly also lowered its cutoff grade of mercury ore and thereby increased its reserve to over 1 million tons of ore, averaging 2.5 to 3.0 percent mercury.

Nickel.—The Marinduque Mining and Industrial Corp. formally announced at yearend 1969 that it would proceed with the development and construction of a mine and refinery to produce nickel from low-grade laterites found in the Surigao Mineral Reservation. Ore reserves at the property are estimated at over 100 million tons, assaying about 1.45 percent nickel. The project is planned to produce 34,000 tons of nickel annually, and will employ a hydrometallurgical refining process developed by Sheritt-Gorden Mines Ltd. of Canada. The proposed output constitutes approximately 5 to 7 percent of the 1968 world nickel production.

Total costs of the project are estimated at $160 million; Bechtel Corp. of the United States is designing the mining and milling facilities, while Kobe Steel of Japan reportedly is supplying a $55 million nickel plant. Groundbreaking for the project will be in January 1970, and commercial operations may commence at yearend 1972. Two other major lateritic nickel deposits in the Philippines have been outlined by A. Soriano and Co. on Palawan and Mindanao. Work on Palawan has indicated a possible deposit of 97 million tons assaying 1.37 percent nickel. The Mindanao deposits have indicated ore reserves of 110 million tons assaying 1.27 percent nickel. Atlas Consolidated and Mining reportedly has been granted the option to acquire mining rights over the two properties.

NONMETALS

Cement.—The Philippine cement industry experienced an unfavorable year in 1969, as a cement glut engulfed practically all 12 cement firms. The oversupply was largely due to the Philippine Central Bank's low priority in granting loans for construction projects as a result of foreign exchange difficulties. Although industry capacity (about 3.8 million tons in 1969) has grown 18 percent annually during the past 10 years, cement consumption has increased only 15 percent annually during the same period. Nevertheless, five new plants are presently under construction and three more are in advanced stages of negotiation or financing. Completion of these projects will bring total annual cement capacity to over 8.5 million tons by the early 1970's. Increased efforts were being made by the cement industry to market outside the Philippines, but such prospects appear dim due to stiff competition with the area's other big marketers, such as Japan and Taiwan.

Fertilizers.—The Philippines fertilizer industry continued to experience a slump in

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sales, as Japanese fertilizer imports saturated the market. Three leading producers, Esso Standard Fertilizer & Agricultural Chemical Co., Maria Cristina Fertilizer Corp., and Chemicals Industries of the Philippines, Inc., incurred sizable losses in 1969. However, the industry's future prospects are more favorable, as the country's foreign exchange shortages will restrict significant amounts of future foreign imports. This was indicated as Japanese fertilizer contracts were cut in half for 1970. In addition, new projects and expansions being planned include Atlas Fertilizer Corp.'s plans to increase phosphoric acid production at its Manila plant, Sugar Producers Corporated Marketing Association's contract with Japanese sources to construct a series of fertilizer plants valued at $40 million, and Farmers Fertilizer Corp.'s plans to build with Japanese aid a $40 million fertilizer plant with a daily capacity of 1,000 tons of urea and 600 tons of ammonium fertilizers.

Sulfur.—Benguet sulphur and Chemical Corp., a subsidiary of Benguet Consolidated, is developing a sulfur deposit at Dumaguete, Negros Oriental. The deposit reportedly contains over 30 million tons of ore containing 30 percent elemental sulfur. The company hopes to start production in 1971 with initial output from the mine expected to be about 2,000 tons per day. The sulfur will be mined by open-pit methods and a subsequent decision will be made whether refining will be done by autoclave or solvent methods.

MINERAL FUELS

Petroleum.—All petroleum needs were again supplied by imports, as all efforts to find significant quantities of oil in the Philippines have failed. The Philippine Government in mid-1969 called for exploration bids on four areas, including the promising offshore area bordering Sabah.

Philippine refineries have a crude distillation capacity of about 180,000 barrels per day. Four refineries were in operation: the 60,000-barrel Batangas refinery of Caltex (Philippines) Inc., the 55,000-barrel Tabangao refinery of Shell Refining (Philippines) Inc., the 50,000-barrel Bataan refinery of Bataan Refining Corp., and the 15,000-barrel Rosario Cavite refinery of Filoil Refinery Corp.

A new pipeline system linking the Caltex refinery at Batangas and metropolitan Manila was completed in early 1969. The system, consisting of a 14-inch white petroleum product pipe and a 16-inch black fuel pipe, was constructed at a cost of over $10 million. Operation began in mid-1969 with an initial run of 3.9 million barrels of white and 2.8 million barrels of black oil products.

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The Mineral Industry of Poland

By Bernadette Michalski [1]

The mineral industry continued to be a major contributor to Poland's economy in 1969, providing an estimated 12 percent of the gross national income. The industry employed nearly 1.3 million workers or about a third of the total industrial employment. Total industrial growth in 1969 was estimated at a little more than 8 percent.

Significant among the mineral industries were coal and sulfur, the output of which ranked Poland about fifth in world production. The Nation took seventh position in world zinc production while ingot steel production, based on imported ores and domestic fuels, placed Poland tenth among steel producers.

Using both domestic and imported raw materials, Polish manufacturers have made notable advances in meeting domestic consumer requirements, particularly in the metals sector and to some degree in the liquid fuels and chemical sectors. Emphasis has now been transferred from the domestic consumer market to the export market. The economic council of the Communist Party has reappraised past investment methods and has adopted a new investment code awarding priorities to those industries which are export-oriented, which give a quick return on capital outlay, which provide for an improved foreign exchange balance, and which move most quickly into production.

PRODUCTION

The notable increases registered by the natural gas, nonferrous metals, petroleum refining, and sulfur industries mostly reflect new capacities developed or constructed in late 1968. Prominent among these were new gas wells in the Krakow and Rzeszow regions, copper mine development at the Lubin Glogow Basin, increased zinc-lead mining activity at Bytom, Chrzanow, and Olkusz, the installation of an Imperial Smelting furnace in Miasteczko Slaskie, the opening of the Jan automated coal mine, expanded capacity at Plock petroleum refinery, and Frasch sulfur mining activity at Grzybow and Jeziorko. New developments in 1969 included opening of the Machow open-pit sulfur mine, the triple superphosphate unit at Gdansk, and an ammonium phosphate unit at Police.

In addition to the development and installation of new capacities the mineral industry has undergone modernization and mechanization which are most evident in the steel and coal mining industries.

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[1] Foreign mineral specialist, Bureau of Mines, Washington, D.C.

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Table 1.—Poland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
Metals			
Aluminum:			
Metal, primary	92,400	93,500	96,800
Cadmium, metal including alloys, all forms e	r 415	r 415	420
Copper:			
Mine output, metal content e	16,500	r 26,600	48,300
Metal:			
Blister	27,000	28,000	e 48,000
Refined, including secondary	42,200	43,600	54,700
Iron and Steel:			
Iron ore and concentrate thousand tons	3,077	3,050	2,822
Pig iron including blast furnace ferroalloys do	6,581	6,839	7,028
Steel, ingots and castings do	10,454	11,007	11,291
Steel, semimanufactures do	7,593	7,327	7,655
Lead:			
Mine output, metal content	44,700	r 48,000	e 49,000
Metal, including secondary	44,800	42,000	50,700
Nickel:			
Mine output, metal content e	1,500	1,500	1,500
Silver e thousand troy ounces	160	160	165
Zinc:			
Mine output, metal content	156,600	r 165,100	e 167,000
Metal, refined, including secondary	196,000	202,500	207,500
Nonmetals			
Barite e	47,000	47,000	50,000
Cement, hydraulic thousand tons	11,138	11,600	11,830
Feldspar e	28,000	28,000	29,000
Fertilizer materials:			
Crude (natural):			
Phosphate rock	e 95,000	e 95,000	e 100,000
Manufactured:			
Nitrogenous:			
Gross weight thousand tons	2,035	2,506	e 3,200
Nitrogen content do	594	759	938
Phosphatic:			
Gross weight do	1,972	2,415	2,700
P_2O_5 content do	380	474	534
Gypsum and anhydrite:			
Calcined do	153	167	e 170
Crude e do	755	790	e 810
Lime (quicklime and hydrated lime) do	2,358	2,293	2,300
Magnesite, crude e	45,000	45,000	45,000
Pyrite and pyrrhotite (including cupreous):			
Gross weight e	240,000	r 225,000	225,000
Sulfur content e	91,000	r 88,000	88,000
Salt:			
Rock thousand tons	830	969	1,166
Other do	1,658	1,665	1,651
Sulfur, elemental:			
Frasch process do	e 230	842	1,321
Other native do	e 492	495	660
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	349,200	408,000	NA
Coal:			
Bituminous thousand tons	123,900	128,600	134,000
Lignite and brown do	23,922	26,900	30,900
Coke, all types do	15,200	15,700	16,166
Fuel briquets, all grades do	901	931	e 950
Gas, natural, marketed million cubic feet	55,373	90,264	137,250
Peat thousand tons	41	28	20
Petroleum:			
Crude oil do	450	475	439
Refinery products:			
Gasoline, aviation and motor do	1,013	1,481	1,499
Kerosine do	19	42	50
Other do	3,644	4,197	5,350

e Estimate. p Preliminary. r Revised. NA Not available.

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TRADE

Poland's overall foreign trade approached equilibrium in 1968 with exports totaling $2,860 million [2] and imports totaling $2,870 million. Mineral commodity trade, however, continued to show an increasing deficit with imports at $742 million exceeding exports by $139 million. The most notable increases in import values were those recorded for petroleum and steel and these offset gains recorded in exports of coal and coke, Poland's dominant mineral commodity exports, which together accounted for about half of the Nation's total mineral export value or $344 million.

Imported crude oil and petroleum products were valued at $173 million in 1968. The development of the domestic refining industry was reflected in the decreasing share of the total imports accounted for by petroleum products and the increasing share accounted for by crude oil. Growth in petroleum product exports also reflects the growth of the Polish oil refining industry, but despite these exports, the net trade balance deficit in oil remains sizable; in 1967 it totaled $132 million, increasing to $150 million in 1968.

Imports of iron ore, pig iron, and steel semimanufactured products resulted in the steel industry having a net trade deficit of $124 million in 1967 and $136 million in 1968.

About 70 percent (by value) of the 1968 total mineral commodity trade turnover was reportedly conducted with other Communist Economy (Comecon) nations. This figure, however, only indicates a general order of magnitude because many commodities entering Comecon trade channels are not valued in accordance with world market prices. Poland continued efforts to expand export markets in hard currency nations. Although sulfur and semiprocessed metals exports to the non-Comecon nations increased appreciably in 1968 and 1969, fuels still constituted the bulk of exports to this area. Coal and coke exports to non-Comecon nations totaled $105 million in 1968 and $89 million in 1967.

The 1969 Communist Party Plenum edict accelerating investments in those industries directly affecting the foreign exchange balance should bring about increasing exports of coal, sulfur, copper, and finished steel products. Exports to non-Communist hard currency nations will increase in all of these commodities with the probable exception of copper, exports of which are slated, at least for the immediate future, for the Comecon nations.

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[2] Where necessary, values have been converted from Polish zloty (ZL) to U.S. dollars at the official exchange rate of ZL1=US$0.25.

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Table 2.—Poland: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Cadmium, metal including alloys, all forms	281	289	U.S.S.R. 200; West Germany 40.
Iron and steel:			
Iron ore and concentrate	19,000	7,000	United Kingdom 5,000.
Scrap	33,384	152,494	West Germany 56,170; Italy 43,000; Czechoslovakia 37,151.
Pig iron including cast iron	280,013	445,020	Japan 306,102.
Ferroalloys	289	1,059	West Germany 634; Austria 295.
Semimanufactures, thousand tons	1,149	1,412	Czechoslovakia 156; U.S.S.R. 139; United States 114; Rumania 98.
Lead, ore and concentrate	18,903	9,238	All to West Germany.
Zinc, metal including alloys, all forms	92,424	99,279	U.S.S.R. 34,960; Czechoslovakia 12,681.
Other, nonferrous metal scrap	31,103	16,321	Austria 7,227; Sweden 4,209.
NONMETALS			
Cement	736,117	225,383	Brazil 66,582; East Germany 46,442; Nigeria 27,254; Czechoslovakia 8,187.
Clays:			
Bentonite	168	649	All to Czechoslovakia.
Refractory	59,642	61,800	Hungary 20,634; Italy 17,482; Yugoslavia 13,271.
Fertilizer materials:			
Manufactured:			
Nitrogenous, thousand tons	85	159	East Germany 65; India 54.
Gypsum and plasters:			
Gypsum, do.	417	512	Sweden 198; Denmark 99; Norway 84.
Plasters, do.	31	29	Finland 20; Austria 7.
Lime	43,042	66,869	Czechoslovakia 39,579; Hungary 11,750.
Pyrite (gross weight)	54,565	37,055	Czechoslovakia 25,253.
Salt, excluding brines, thousand tons	85	119	Hungary 35; Finland 31; Sweden 17.
Stone:			
Dolomite	3,094	3,232	Czechoslovakia 3,095.
Granite	22,681	27,219	Netherlands 25,903.
Sulfur, elemental, thousand tons	404	965	Czechoslovakia 165; France 102; Tunisia 94; United Kingdom 62; Italy 45; Austria 44.
MINERAL FUELS AND RELATED MATERIALS			
Coal and briquets:			
Anthracite and bituminous, thousand tons	24,029	26,002	U.S.S.R. 6,927; Denmark 3,475; East Germany 2,400.
Lignite and lignite briquets, do.	3,706	4,002	All to East Germany.
Coke, do.	2,344	2,410	East Germany 852; U.S.S.R. 659; Hungary 290.
Gas, manufactured, million cubic feet	425	351	All to East Germany.
Petroleum, refinery products, thousand tons	673	1,473	Austria 338; West Germany 303; Denmark 217.

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Table 3.—Poland: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources in 1968
METALS			
Aluminum:			
Bauxite and concentrate	107,815	112,255	All from Hungary.
Oxide and hydroxide	167,312	196,298	Hungary 139,998; United Kingdom 10,490.
Arsenic trioxide	601	589	U.S.S.R. 345; Sweden 170.
Bismuth, metal including alloys, unwrought	105	121	United Kingdom 116; Netherlands 5.
Chromite	150,238	136,971	U.S.S.R. 75,964; Albania 27,092.
Copper:			
Ore and concentrate	18,631	17,331	Chile 8,779; Belgium-Luxembourg 2,755.
Metal, including alloys, unwrought	37,693	35,446	United Kingdom 21,411; Belgium-Luxembourg 4,972.
Iron and steel:			
Ore and concentrate thousand tons	10,056	11,106	U.S.S.R. 10,008.
Pig iron, including cast iron do.	704	949	U.S.S.R. 941.
Ferroalloys	5,930	7,964	U.S.S.R. 4,138; Bulgaria 1,948.
Semimanufactures thousand tons	901	984	U.S.S.R. 405; Czechoslovakia 146.
Lead, metal including alloys, unwrought	17,089	18,677	Tunisia 5,991; Yugoslavia 5,507; U.S.S.R. 4,004.
Magnesium metal, including alloys, all forms	471	400	All from U.S.S.R.
Manganese:			
Ore and concentrate	354,025	351,075	U.S.S.R. 317,974; Cuba 22,000.
Oxides	4,550	5,718	U.S.S.R. 2,107; Morocco 2,024.
Mercury 76-pound flasks	10,123	6,700	United Kingdom 2,466; Italy 1,595; Switzerland 1,015.
Molybdenum, ore and concentrate	158	444	Canada 202; United Kingdom 110.
Tin metal, including alloys, all forms long tons	3,171	3,246	United Kingdom 2,582; Netherlands 600.
Tungsten, ore and concentrate	2,445	3,250	United Kingdom 2,750.
Zinc, ore and concentrate	107,274	85,861	U.S.S.R. 16,889; West Germany 16,213; Canada 15,179; Norway 10,960.
Other:			
Nonferrous ores and concentrates	3,537	5,593	United Kingdom 5,170.
Nonferrous metal scrap	13	300	Belgium-Luxembourg 104; Netherlands 100.
Nonferrous rolled metal	13,166	12,237	U.S.S.R. 4,975; Yugoslavia 2,030; Hungary 1,052.
NONMETALS			
Asbestos	42,632	42,241	U.S.S.R. 26,878; United Kingdom 4,614.
Barite	26,501	12,392	Mainland China 9,715.
Cement	214,236	319,535	U.S.S.R. 282,765.
Clays:			
Bentonite	4,233	4,881	Yugoslavia 3,747.
Kaolin (china clay)	71,313	79,047	Czechoslovakia 45,008; East Germany 17,053.
Cryolite	4,421	4,276	France 1,780; U.S.S.R. 1,432.
Diatomite	1,272	1,441	Belgium-Luxembourg 760; United States 660.
Fertilizer materials:			
Crude:			
Phosphatic thousand tons	435	532	All from U.S.S.R.
Manufactured:			
Nitrogenous do.	68	52	All from Czechoslovakia.
Phosphatic do.	695	974	Morocco 600; Tunisia 344.
Potassic do.	1,700	1,796	East Germany 1,229; West Germany 328.
Fluorspar	30,442	33,349	Mainland China 20,782.
Graphite, natural	10,012	11,569	Austria 6,535; U.S.S.R. 3,192.
Magnesite	104,147	152,757	North Korea 81,529; Czechoslovakia 53,718.
Mica, all forms	1,158	1,126	India 713; Belgium-Luxembourg 410.
Talc	10,271	17,547	North Korea 6,503; Austria 4,326.
MINERAL FUELS AND RELATED MATERIALS			
Coal and briquets:			
Anthracite and bituminous coal thousand tons	1,243	1,289	U.S.S.R. 919; East Germany 299.
Lignite and lignite briquets do.	223	136	All from East Germany.
Gas, hydrocarbon:			
Natural million cubic feet	39,152	35,304	All from U.S.S.R.
Manufactured do.	116	113	All from East Germany.
Petroleum:			
Crude thousand tons	3,608	5,582	All from U.S.S.R.
Refinery products do.	2,784	2,535	U.S.S.R. 1,587; Rumania 308; East Germany 242.

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COMMODITY REVIEW

METALS

Aluminum.—The 3.5-percent increase in aluminum output during the year probably reflected more efficient utilization of the Péchiney equipment at the Konin aluminum plant. This plant, Poland's second aluminum refinery, was placed in operation in 1966 but has experienced difficulty in reaching optimum production levels resulting in a habitual below-plan output for the aluminum industry. Poland's two smelters, the Skawina and Konin, each have a capacity of approximately 55,000 metric tons. An eventual 100,000-ton capacity is planned for the latter. Some reports indicate that additional capacity was installed at Konin in April of 1969; however, actual production in 1969 and a planned production of 98,600 tons for 1970 do not substantiate this claim. However, a large sheet rolling mill was under construction at Konin, with completion scheduled for 1970.

Because there are no economic indigenous bauxite deposits, raw material requirements for the Polish aluminum industry are met entirely from imports. However, the Institute of Binding Building Materials at Opole has continued experiments involving the production of alumina from shales and limestone as a coproduct in the manufacture of cement. The Groszowice Cement mill was converted during 1968–69 to an experimental center for this operation. The production technique employed at the mill will annually yield an anticipated 6,000 tons of alumina. Polish operators hope that experience gained at Groszowice may be applied at a proposed larger scale plant to be constructed at Nowiny in Kielce province, which will use colliery shale.

Copper.—The considerable growth registered by the copper industry in 1969 reflected the full-year operation of the Lubin-Glogow mines at Legnica. Development of the Rudna mine was undertaken during the year, and plans for a fourth mine in the Legnica area were reportedly underway. The Legnica electrolytic copper refinery, expanded in 1967 from a 40,000 to 60,000 ton annual capacity, operated near capacity during the year. Construction of the Zukowice electrolytic refinery was accelerated, and completion of the 40,000-ton-annual-capacity refinery was scheduled for the first quarter of 1970.

The intense activity in the copper industry reflects the policy of selective industrial development adopted by the Party Plenum in early 1969. Under the policy, investment funds are channeled to those areas affording optimum advantage in conserving or gaining foreign exchange.

Germanium.—The Warszawa Steel Works has announced the construction of facilities for the production of 800 kilograms of germanium dioxide annually as a byproduct of other operations. The origin of the germanium and the method by which it will be recovered was not indicated. Available sources do not record any coking facilities at this plant, but the possibility of germanium recovery from coal and/or from some phase of steelmaking cannot be discounted.

Iron and Steel.—Poland's iron and steel industry retained tenth position among world crude steel producers in 1969, accounting for just under 2 percent of total world output. A development program was announced under which output is to be doubled to 22 million tons by 1980. This increase reportedly is to be effected wholly through reconstruction and expansion of existing crude steel plants rather than by constructing entirely new plants. Plans include a greater emphasis on facilities for oxygen converter steel. In 1969, oxygen converter steel constituted a little more than 10 percent of total output, and by 1980 it is slated to constitute 40 percent of the planned total, or about 9 million tons.

As a part of the development program, Poland's major steelworks were undergoing expansion and modernization throughout 1969. In addition to efforts directed toward expansion of crude steel capacity, existing billet stamping and rolling facilities were being expanded and modernized in an attempt to bring downline processing capacity into better alignment with crude steel capacity and with both present and anticipated domestic demand for various products. In the past, Polish sources have commented on the disparity between crude and finished steel capacity as well as on a decided trend toward increased needs for

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high-grade steels, a trend expected to continue and which has not been met by changes in domestic processing.

About 60 percent of the 1969 total pig iron output and 40 percent of the 1969 crude steel output came from the integrated Lenin Iron and Steel Complex at Nowa Huta. Principally an open-hearth steelmaking plant, the complex also includes two oxygen-converters each of 100 tons capacity. A third similar converter is included in the plant's development program which will contribute to the facility's 1972–73 proposed crude steel capacity of 5,500,000 tons. (1969 capacity 4,200,000 tons). In 1969, as part of the overall steel capacity development program, construction reportedly was underway on a tandem-type furnace, the first of its type in a Polish steel plant. It will be the seventh such furnace installed in the world and the largest yet built. This unit, with two 200-ton-capacity tubs, will utilize a new oxygen refining process, with optimum utilization of furnace gas heat for smelting the charge. The installation, scheduled for completion in the first quarter of 1970, will replace two open-hearth furnaces.

The Bierut Steel Works which has an annual crude steel capacity of 1 million tons was undergoing expansion to a capacity of 4.5 million tons. The expansion will include installation of oxygen converters. A thick-metal sheet mill was also under construction during 1969. It is claimed that this mill will be the largest in Europe. The schedule of continuing construction on the second stage of the Srem foundry was accelerated from 39 to 27 months under the new Government policy endorsing accelerated development for enterprises earning or conserving foreign exchange. The Srem foundry supplies all the castings for the H. Cegielski Works, manufacturers of diesel engines and machine tools, principal export commodities.

Lead and Zinc.—Mining activity was centered at Bytom, Chrzanow, and Olkusz with ores averaging 5 percent zinc and 1 percent lead. A new deposit was discovered at Siewierz near the Olkusz–Boleslawiec region but no information as to ore type or reserves was made available.

The expanded output of zinc and lead metal is attributable to the full-year operation of the Imperial Smelting Furnace at Miasteczko Slåskie. The furnace has a 17.2-square-meter shaft and one condenser. Cowper stones are used to preheat the blast. The Miasteczko Slåskie Complex also includes a sinter plant for treatment of a high percentage of Waelz oxide in the feed using fine coke as additional fuel.

NONMETALS

Fertilizer Materials.—In response to agricultural demands domestic production and imports of fertilizer raw materials and domestic output of manufactured fertilizers have increased significantly in recent years. Most notably, nitrogenous fertilizer production has more than doubled since 1966, While more than adequately meeting domestic requirements for nitrogenous fertilizers the fertilizer industry also supplies the bulk of Polish requirements for phosphatic fertilizers, the latter manufactured principally from raw materials. Phosphate rock imports in 1969 totaled 1.8 million tons principally from the U.S.S.R., Morocco, Tunisia, and Algeria. The remaining Polish requirement for phosphatic fertilizers and the entire 2-million-ton requirement for potassic fertilizers are met through imports, with East Germany traditionally supplying more than half and the remainder supplied by France, Spain, and West Germany.

About half of the nitrogen fertilizer production was from the Pulawy complex. The Pulawy I plant's daily capacity is 900 tons of ammonia with associated facilities for daily production of 1,500 tons of urea containing 46 percent nitrogen. A third ammonium nitrate unit of 1,200 tons daily capacity built by Kaltenbach and Cie (French) was commissioned during the year, bringing total ammonium nitrate capacity at Pulawy II to 1.2 million tons annually. Additional nitrogen fertilizer facilities were under construction during the year including the Wroclawek Works scheduled for completion in 1971 with a daily capacity of 1,500 tons of ammonia.

Increased production of phosphatic fertilizer was made posible during 1969 with the opening of a triple superphosphate unit at the Gdansk phosphate fertilizer plant. Designed and built by Dorr–Oliver, Inc. (a United States firm) the unit has an annual capacity of 138,000 tons of P_2O_5 equivalent. Production of granulated superphosphate in 1969 amounted to an estimated 150,000 tons of 47.5 percent P_2O_5,

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and about double that amount is anticipated for 1970 at Gdansk. At Police, an ammonium phosphate unit with annual capacity of 230,000 tons was commissioned at yearend. When all units of the Police complex are completed in 1973, Poland will launch production of more complex fertilizers.

Sulfur.—Polish sulfur production recorded another major increase in 1969 with total output reaching more than 1.9 million metric tons, an increase of 48 percent over the previous record level of 1968. The production climb reflects expanded operations at the Jeziorko and Grzybow Frasch mines and the opening, near yearend of the Machow opencast mine. The commissioning of the Machow mine on the east Bank of the Vistula River is a part of a phase-out plan for the Piaseczno opencast mine on the west bank of the river where sulfur bearing limestones have been mined since 1962 and workings now approach the river's edge. A complete transfer of opencast mining from the west to the east bank reportedly will be affected by mid-1970. Piaseczno ores are beneficiated at a 500,000-ton-annual-capacity flotation plant on the east bank. A second flotation plant with an initial operating capacity of 500,000 tons of sulfur concentrates was commissioned for the treatment of the Machow ores. A three-stage flotation process is used at the plant. First stage concentration yields a product containing 60 percent sulfur, which is upgraded to 70 to 72 percent in the second stage and to 84 percent in the third stage. The third stage product can be melted and filtered while still hot to yield 99.5 percent sulfur in liquid form together with a solid residue containing about 40 percent sulfur; the latter is used in the manufacture of sulfuric acid.

About 400,000 tons of sulfur is consumed domestically, principally by sulfuric acid manufacturers whose increasing demands are closely linked to the growth of the fertilizer industry. Two new sulfuric acid plants were commissioned during 1969. Both the Gdansk and Police plants have a reported annual capacity of 350,000 tons of sulfuric acid. Total sulfuric acid output was 1.5 million tons in terms of 100 percent H_2SO_4 in 1969.

About 1.4 million tons of sulfur was exported during 1969. Of this total an estimated 1.1 million tons was bound for western markets, with the United Kingdom and France among the leading importers.

MINERAL FUELS

Solid fuels remained the Nation's leading energy source, supplying about 75 percent of Poland's 1969 energy requirement. However, discovery of additional gas reserves and expanded petroleum refinery output have begun to alter the fuel balance. The 1971–75 plan has alloted the expenditure of $2.25 billion for the development of the natural gas deposits and the means of marketing. By 1975 Poland anticipates an annual output of 423 billion cubic feet of natural gas, an amount expected to supply about 23 percent of the Nation's energy requirement in that year. Projections on petroleum refining development anticipate that refined petroleum will provide 27 percent of all energy consumed in 1980. The refinery and development program will stress production of gasoline and distillate oils, increasing the share of total output accounted for by these products.

Coal.—The 4.2 percent increase in output of bituminous coal over that of 1968 is largely attributable to increased productivity. Emphasis on mine mechanization and automation involves the planned receipt of an additional 750 mechanical coal cutters, 100 complex mechanized long wall mining units, over 900 loaders of various types, and almost 5,000 conveyers during 1969–71. Mechanical loading methods accounted for 77 percent of all underground coal loaded in 1969 compared with only 3 percent in 1950.

The mean daily production per colliery has risen from 3,740 tons in 1959 to 5,170 tons in 1969. Average daily production per mining face grew from 54.7 metric tons to 173.8 metric tons in the same period. The Jan mine, an experimental automated mine, opened in December 1968, provided for full-scale testing of new systems of automation. The mine was laid out on a longwall retreating system. The longwall face in the mine is 540 feet long and equipped for fully automatic operation. Output from the longwall face was 2,500 tons per day. Experience gained in complete face automation will be employed in modernization and expansion of operations in the Rybnik coal basin in upper Silesia.

Coal output in 1970 is anticipated at 142 million tons. The use of automation and

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mechanization will contribute to an output planned at 160 million tons by 1975.

Coal exports continued as Poland's principal foreign exchange earner. Exports of hard coal totaled 26.4 million tons in 1969, with the U.S.S.R., Denmark, and Italy as principal recipients.

Natural Gas.—Proven natural gas reserves located principally in southeastern Poland were estimated at 1,624 million cubic feet in 1967. New gas deposits in central Poland and near Zamosc near the eastern border, discovered in 1968 and 1969, contributed an additional reserve estimated as high as 5,156 billion cubic feet.

The more than 52-percent increase in gas production over that of the prevous year is largely attributable to full-year operation of Poland's largest oil-gas well located at Bochnia in the Krakow region and the operation of new gas wells in the Przemysl region. During the year, preparation of gas wells at Ostrawa Wielkopolska and Lezajk was underway, assuring another substantial increase in gas output in 1970.

In addition to domestic output, about 35 billion cubic feet of natural gas was imported from the U.S.S.R. in 1969. While much of the available gas supplied fuel for heavy industry, about 21 billion cubic feet was consumed in 1969 as feedstock for the chemical industry. By 1970 annual chemical industry consumption requirements for feedstock gas are anticipated to be 70 billion cubic feet.

Petroleum.—Activity in exploration continued throughout 1969. The petroleum industry reported a total of 1.550 million feet drilled during the year of which 1.400 million feet were drilled for exploration and the remainder for production. Domestic crude petroleum output in 1969 contributed less than 10 percent of the refinery throughput; the bulk of the refinery throughput was imported from the U.S.S.R. Six refineries were in operation in Poland; however, the bulk of product output was from the Plock refinery, which yielded about 5.5 million tons of petroleum products of a total national output of 6.9 million tons.

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The Mineral Industry of Portugal

By F. L. Klinger [1]

The activity in Portugal's mineral industry in 1969 was not appreciably changed from that of 1968. Declines in mine output of iron ore, tungsten and tin ores, and pyrites appeared to be temporary. Development of the Moncorvo iron ore deposits was continued; new production facilities for tungsten and tin were under construction at the Panasqueira and Ribeira mines; and a new investment project was announced for mineral deposits in the Aljustrel region. Increased output of iron and steel appeared to indicate growth in capacity of the Seixal works. Demand for nonmetallic construction materials increased in 1969, and production capacity for cement was scheduled to rise by 50 percent by 1971. A continuing decline in output of coal was accompanied by increased consumption of liquid fuels, the completion of Portugal's second petroleum refinery, and construction of oil-fired thermal powerplants near Lisbon. Several companies were interested in offshore exploration for oil and gas, but no concession awards were announced by yearend.

PRODUCTION

In the mining industry, declines in production of iron and manganese ores, tungsten and tin concentrates, pyrite, and coal occurred in 1969. The output of tungsten concentrates dropped by 4 percent, but the total reported value was 10 percent more than in 1968. Increased output of silver and zinc was realized at the Terramonte mine, but the grade of ore appeared to be lower. Production gains were reported for quartz, feldspar, and salt, and increased output of dimension stone was suggested by the volume of exports.

In the processing industries, significant gains in production of iron, steel, and cement were accompanied by reduced output of nonferrous metals and fertilizers. Output of petroleum products increased only slightly, but a sharp rise in production was expected in 1970.

[1] Physical scientist, Bureau of Mines, Washington, D.C.

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Table 1.—Portugal: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Antimony, mine output, metal content	23	r 20	NA
Arsenic, white	252	183	• 200
Beryl concentrate, gross weight	14	r 128	27
Columbite-tantalite concentrates, gross weight	14	r 12	7
Copper:			
Mine output, metal content:			
In cupreous pyrites	3,471	4,279	• 4,000
In other ore and concentrate	139	r 188	101
In precipitate	58	r 54	66
Total	3,668	4,521	• 4,167
Metal, refined	3,857	3,889	3,688
Gold:			
Mine output, metal content, troy ounces	27,108	r 17,894	17,758
Metal, do	20,191	22,666	NA
Iron and steel:			
Iron ore and concentrate:			
Hematite and magnetite, thousand tons	143	149	108
Manganiferous, do	54	55	56
Pig iron, do	278	281	335
Ferroalloys, excluding blast furnace products:			
Ferromanganese and ferrosilicon	7,130	7,159	NA
Ferrotungsten	370	299	373
Steel, ingots, thousand tons	302	r 302	387
Steel semimanufactures:			
Light sections, do	152	r 280	290
Other, do	79		
Lead:			
Mine output, metal content	1,594	r 1,926	1,822
Metal, refined	1,078	r 1,227	1,074
Manganese ore and concentrate, gross weight	9,832	9,663	6,960
Silver:			
Mine output, metal content, troy ounces	356,789	327,000	338,765
Metal, including secondary, do	275,210	296,365	NA
Tin:			
Mine output, metal content, long tons	645	r 668	440
Metal, do	592	619	496
Titanium (ilmenite concentrate), gross weight	535	r 604	127
Tungsten, mine output, metal content	1,096	r 1,383	1,255
Uranium oxide (U_3O_8) produced •	r 95	95	95
Zinc, mine output, metal content	507	361	1,553
NONMETALS			
Asbestos	52	r 85	203
Barite	316	r 320	108
Cement, hydraulic, thousand tons	1,821	1,861	2,036
Clays:			
Kaolin	37,209	r 41,408	41,644
Other	52,000	46,000	NA
Diatomite	r 3,499	3,512	2,834
Feldspar	30,321	21,239	24,030
Fertilizer materials, manufactured:			
Nitrogenous, gross weight, thousand tons	507	579	478
Phosphatic, gross weight, do	491	489	451
Mixed and unspecified, do	167	165	195
Total, do	1,165	1,233	1,119
Gypsum and anhydrite, do	104	106	• 110
Lime (quicklime and hydrated lime), do	201	192	• 200
Mica, all grades	1,657	2,116	• 2,000
Pyrite and pyrrhotite (including cupreous), gross weight:			
Noncupreous, thousand tons	174	128	531
Cupreous, do	354	433	
Total, do	528	561	531
Sulfur content, do	248	254	• 240
Quartz:			
Common quartz	60,545	r 54,318	90,909
Quartzite	276,000	190,000	NA
Salt:			
Rock, thousand tons	113	151	166
Marine, do	321	263	• 300

See footnotes at end of table.

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Table 1.—Portugal: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
NONMETALS—Continued				
Stone, sand and gravel, n.e.s.:				
Stone:				
Calcareous:				
Dolomite		5,340	12,196	NA
Limestone, including marl and calcite	thousand tons	2,782	3,427	NA
Marble	do	181	168	NA
Other:				
Granite	do	2,042	1,553	NA
Slate	do	67	70	NA
Other	do	377	436	NA
Gravel	do	219	160	NA
Sand, not further described	do	769	835	NA
Sulfur, elemental, including sublimed		r 4,520	3,762	• 4,000
Talc		140	r 1,460	1,500
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Anthracite	thousand tons	448	397	361
Lignite	do	39	31	8
Coke, gas	do	10	• 10	• 10
Fuel briquets, all grades	do	37	30	29
Gas, manufactured	million cubic feet	3,622	3,810	4,081
Petroleum refinery products:				
Gasoline	thousand tons	407	408	429
Kerosine	do	191	208	196
Jet fuel	do	96	64	62
Distillate fuel oil	do	368	369	401
Residual fuel oil	do	619	609	637
Liquefied petroleum gases	do	34	42	41
Other	do	57	• 50	64
Total	do	1,772	• 1,740	1,830

• Estimate. r Revised. NA Not available.

TRADE

Stone, tungsten concentrates, pyrite, and silver-bearing concentrates of lead and zinc continued to be the principal export products of mines and quarries in continental Portugal in 1969. Combined value of these exports was approximately $21 million,[2] of which building and ornamental stone accounted for about 50 percent.

Preliminary data indicated that imports of unclassified diamonds from Angola were valued at $43.6 million ($55 million in 1968), while exports of gem stones were valued at $42.6 million ($38.7 million in 1968). Exports are usually destined for the United Kingdom.

Imports of iron ore, sulfur, nonferrous metals, crude oil, and coke increased in 1969, while imports of fertilizer materials, iron and steel, and petroleum products were close to the levels of 1968. Imports of coal were sharply reduced.

Imports of crude and processed fuels in 1969 were valued at about $96 million, while imports of iron, steel, and nonferrous metals were valued at approximately $78 million.

[2] Where necessary, values have been converted from Portugal Escudo (Esc) to U.S. dollars at the rate of PE's 28.75 = US$1.00.

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Table 2.—Portugal: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum metal, including alloys, all forms	520	538
Arsenic trioxide, pentoxide, and acids	189	107
Beryl ore and concentrate	28	52
Columbium and tantalum, tantalum ore and concentrate	25	10
Copper:		
Ore and concentrate	33	31
Metal, including alloys, all forms	1,033	526
Iron and steel:		
Ore and concentrate, including roasted pyrite	19	41
Metal:		
Scrap	13,508	35,959
Pig iron, ferroalloys, and similar materials	7,925	6,729
Steel, primary forms	10,581	9,121
Semimanufactures:		
Bars, rods, angles, shapes, sections	2,332	10,423
Universals, plates and sheets	1,690	3,190
Hoop and strip	84	NA
Wire	8,633	23,508
Tubes, pipes, and fittings	19,759	15,639
Castings and forgings, rough	239	414
Lead:		
Ore and concentrate	2,415	3,674
Oxides	89	94
Metal, including alloys, all forms	208	234
Magnesium metal, including alloys, all forms	8	14
Manganese ore and concentrate	6,435	5,795
Nickel metal, including alloys, all forms	43	41
Platinum-group metals and silver:		
Waste and sweepings:		
Silver and platinum—value, thousands	$8	$23
Gold—do	$27	$26
Metals, including alloys:		
Platinum group—troy ounces	1,692	1,596
Silver—do	2,249	7,732
Tin, metal, including alloys, all forms	389	301
Tungsten ore and concentrate	1,500	1,791
Zinc:		
Ore and concentrate	985	(1)
Oxide	104	119
Metal, including alloys, all forms	288	172
Other:		
Ore and concentrate, molybdenum, titanium, vanadium, and zirconium	1,950	850
Ash and residues containing nonferrous metals	1,693	939
NONMETALS		
Abrasives, natural, n.e.s:		
Pumice, emery, natural corundum, diatomite, etc	298	276
Grinding and polishing wheels and stones	183	106
Asbestos	57	10
Barite and witherite	6	10
Cement	69,028	33,961
Chalk	121	161
Clay and clay products (including all refractory brick):		
Crude clays, n.e.s.:		
Kaolin	2,440	436
Other	2,586	1,553
Products:		
Refractory (including nonclay bricks)	r2,544	3,639
Nonrefractory	17,803	10,575
Diamond:		
Gem, not set or strung—value, thousands	$44,552	$38,905
Industrial—do	$681	$608
Feldspar	11,575	9,063
Fertilizer materials, manufactured:		
Nitrogenous	95,725	64,534
Phosphatic	109,498	98,479
Potassic	1,080	327
Other, including mixed	19,829	23,415
Gypsum and plasters	210	203
Lime	3,187	2,265
Mica, crude, including splittings and waste	936	1,622
Pigments, mineral:		
Natural crude	69	95
Iron oxides, processed	44	40
Pyrite (gross weight)	244,177	269,616

See footnotes at end of table.

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Table 2.—Portugal: Exports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1967	1968
NONMETALS—Continued		
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked:		
Marble and other calcareous	105,648	93,751
Slate	9,856	8,133
Granite and other	1,718	24,669
Worked:		
Slate	4,693	7,617
Paving and flagstone	145,650	127,957
Marble and other	16,193	18,562
Gravel and crushed rock	3,856	1,874
Quartz and quartzite	25,276	53,402
Sand, not metal bearing	21,453	29,337
Sulfur, elemental, all forms	1,467	422
Other nonmetals, n.e.s	156	NA
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	306	75
Coal and coke, including briquets	154	266
Petroleum refinery products: [2]		
Gasoline (including natural)	14,068	24,699
Kerosine and jet fuel	101,501	123,824
Distillate fuel oil	10,825	14,970
Residual fuel oil	16,067	17,089
Lubricants	6,339	8,848
Liquefied petroleum gases	2,217	1,177
Other	312	
Total	151,829	190,607

r Revised. NA Not available.
[1] Less than ½ unit.
[2] Excluding bunkers.

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Table 3.—Portugal: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite and concentrate	2,905	1,430
Oxide and hydroxide	690	1,424
Metal, including alloys:		
Scrap	50	23
Unwrought	620	784
Semimanufactures	7,908	8,490
Chromium:		
Chromite	60	79
Oxide and hydroxide	123	95
Copper metal, including alloys:		
Scrap	76	221
Unwrought:		
Blister	1,537	1,948
Refined, unalloyed	3,933	2,976
Master alloys	38	30
Semimanufactures	6,051	6,866
Gold metal, unworked or partly worked, troy ounces	2,959	1,292
Iron and steel:		
Ore and concentrate, including roasted pyrite	43,136	101,596
Metal:		
Scrap	4,573	3,734
Pig iron, ferroalloys, and similar materials	2,599	3,394
Steel, primary forms	4,045	3,443
Semimanufactures:		
Bars, rods, angles, shapes, sections	46,724	37,286
Universals, plates and sheets:		
Heavy, medium, and light plates and sheets, uncoated	118,950	127,860
Tinned plates and sheets	45,646	52,422
Other coated plates and sheets	15,369	12,012
Hoop and strip	25,976	29,117
Rails and accessories	8,053	6,186
Wire	18,691	15,315
Tubes, pipes, and fittings	14,284	24,229
Castings and forgings, rough	569	528
Lead:		
Oxides	46	5
Metal, including alloys:		
Scrap	89	45
Unwrought and semimanufactures	7,647	7,649
Magnesium metal, including alloys, all forms	2	3
Manganese:		
Ore and concentrate	379	555
Oxides	64	45
Mercury, 76-pound flasks	209	232
Molybdenum metal, including alloys, all forms, kilograms	400	400
Nickel metal, including alloys, all forms	253	387
Platinum-group metals and silver, including alloys:		
Platinum group, troy ounces	18,776	152,447
Silver, thousand troy ounces	982	602
Tin:		
Oxides, long tons	12	12
Metal, including alloys, all forms, do	29	62
Titanium:		
Ore and concentrate [1]	349	466
Oxides	2,636	3,113
Zinc:		
Oxides	198	234
Metals, including alloys:		
Unwrought	6,252	6,198
Semimanufactures	308	695
Other:		
Ore and concentrate of base metals, n.e.s	133	268
NONMETALS		
Abrasives, natural, n.e.s:		
Pumice, emery, natural corundum	548	473
Dust and powder of precious and semiprecious stone, value, thousands	$32	$57
Grinding and polishing wheels and stones	242	285
Asbestos	4,301	4,269
Barite and witherite	297	208
Cement	1,950	1,995
Chalk	2,026	2,884
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s:		
Bentonite	1,562	2,639
Kaolin (china clay)	986	2,290
Other	2,330	7,396
Products:		
Refractory (including nonclay bricks)	5,481	7,856
Nonrefractory	538	27

See footnotes at end of table.

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Table 3.—Portugal: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
NONMETALS—Continued			
Cryolite and chiolite		50	48
Diamond, gem, not set or strung	value, thousands	$42,021	$55,171
Diatomite and other infusorial earths		2,055	2,322
Feldspar		852	1,846
Fertilizer materials:			
Crude:			
Nitrogenous		3,616	3,600
Phosphatic		296,761	299,726
Manufactured:			
Nitrogenous		1,114	1,215
Phosphatic		11,292	11,615
Potassic		30,271	28,316
Other, including mixed		21,828	36,392
Graphite, natural		158	188
Gypsum and plasters		14,331	16,325
Magnesite		367	476
Mica, crude, including splittings and waste		92	128
Pigments, mineral:			
Natural, crude		73	56
Iron oxides, processed		1,218	1,511
Salt and brines		11,040	3,915
Stone, sand and gravel:			
Dimension stone, crude and partly worked		698	598
Dolomite, chiefly refractory grade		3,321	3,243
Flint and crushed rock		739	984
Quartz and quartzite		2,052	515
Sand, excluding metal bearing		4,331	3,214
Sulfur, elemental, all forms		18,814	20,810
Talc, steatite, soapstone, and pyrophyllite		2,319	2,642
Other nonmetals, crude, n.e.s		5,554	7,833
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		1,606	1,974
Carbon black		5,113	5,140
Coal, all grades, including briquets	thousand tons	390	392
Coke and semicoke	do.	298	231
Petroleum:			
Crude and partly refined	do.	1,751	1,810
Refinery products:			
Gasoline, including natural	do.	182	199
Kerosine and jet fuel	do.	25	19
Distillate fuel oil	do.	392	516
Residual fuel oil	do.	300	298
Lubricants	do.	51	54
Liquefied petroleum gases	do.	150	167
Mineral jelly and wax	do.	5	4
Other:			
Bitumen and other residues	do.	53	49
Pitch and bituminous mixtures	do.	2	
Mineral tar and other coal, petroleum or gas-derived crude chemicals		7,436	10,750

[1] Includes vanadium and zirconium ores.

COMMODITY REVIEW

METALS

Gold and Silver.—The Mouros mine of Minas de Jalles, Ltda. accounted for all of the mine gold and 12 percent of the mine silver produced in Portugal in 1969. Mouros concentrates averaged 15 ounces of silver and 6.46 ounces of gold per ton.

The remaining silver was contained in lead and zinc concentrates produced at the Terramonte mine. Output of concentrate increased 60 percent, with total content of silver up 20 percent, as compared with the 1968 figures. The higher base metal content of the concentrates suggested that less oxidized ore was processed in 1969, but the average silver content appeared to decline. Most of the output was probably exported to France.

Iron and Steel.—Imports of iron ore and coke increased in 1969, as output of iron and steel rose 20 percent above the level of 1968. Production of crude steel was estimated at 94 percent of available capacity. Imports of iron and steel semimanufactures totaled 313,000 tons.

The $52 million expansion program at the Sexial steelworks was continued. Steelmaking capacity in Portugal, estimated at 400,000 tons annually in 1969, was expected to rise to 540,000 tons by 1972.

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During the same period, production capacity for rolled products was to increase from 327,000 tons to 560,000 tons annually. Most of the new rolling facilities were intended for production of cold-rolled sheet.

Production of pelletized iron ore concentrates from the Moncorvo deposits was expected to begin by 1971.

Tungsten and Tin.—Exports and production of tungsten concentrates were about 4 percent less than in 1968. Beralt Tin and Wolfram, Ltd., which accounted for 62 percent of the national output in 1969, reported that the decline in production was due partly to shortage of labor and partly to lower grade ore.

Output of tin concentrates declined sharply, although the number of producing mines rose to 22. At yearend, the number of mines producing tungsten and tin was 28, including 15 producing tin only, seven producing both tungsten and tin, and six producing tungsten only.

The Beralt Co. hoped to produce 1,700 tons of tungsten concentrates in 1970 and 2,200 tons annually beginning in 1971. Most of this output was expected to come from the Panasqueira and Ribeira mines, under an expansion program costing an estimated $2 million. A hydrocyclone heavy-media plant for concentrating tungsten ore, being built for Beralt by Humphreys and Glasgow Ltd. of Canada, was scheduled for completion in late 1970. The plant will use a "Stamicarbon" process developed by Dutch State Mines, to preconcentrate 110 tons per hour of minus ½-inch crushed ore.

Some concentrates were produced from development ore at the Ribeira tin-tungsten mine, in which Beralt has an 80-percent interest. The mine is being prepared for limited production at a cost of about $400,000. Development for full production reportedly would require a further investment of $480,000.

NONMETALS

Cement and Other Construction Materials.—Production of cement in 1969 rose to 84 percent of total capacity, compared with an estimated 75 percent in 1968. Apparent consumption was approximately 2 million tons. Portugal's production capacity was scheduled to increase by 50 percent, to 3.6 million tons annually, in 1971. Four new kilns were under construction, one of which will have a capacity of 550,000 tons annually.

Stone.—Exports of building and ornamental stone in 1969 totaled 254,000 tons, valued at more than $11 million. Crude and worked marble accounted for 50 percent of the volume and 70 percent of the value of all stone exported; the volume was 15 percent more than in 1968 and was close to the record levels of 1965–66. Exports included 10,000 tons of slate and 115,000 tons of other worked stone. The principal destinations continued to be Italy (crude marble), the United States (worked marble), and West Germany (other worked stone).

Detailed statistics on the ornamental stone industry were published in late 1969. The data revealed that output of ornamental stone in 1968 was 205,000 tons with a total value (at the quarry) of nearly $5 million, produced from 419 quarries employing a total of 3,800 persons. Salient statistics for localities producing ornamental stone valued at more than $100,000 in 1968 are shown in the following tabulation:

Type of stone and locality	Number of quarries	Number of workers	Production (thousand tons)	Value (thousand dollars)
Marble:				
Vila Viçosa, Évora Estremoz, Évora	167	2,285	111	8,028
Pêro Pinheiro, Lisboa	69	354	20	498
Trigaxes, Beja	19	143	9	231
Viana do Alentejo, Évora	13	127	7	187
Montemor-o-Novo, Évora	6	65	4	102
Limestone:				
Porto de Mós, Leiria	29	182	12	180
Granite:				
Porto and Braga Districts	NA	NA	11	256
Nepheline syenite:				
Monchique, Faro	12	118	4	105
Percent of national total	•80	•90	86	92

• Estimate. NA Not available.

Source: Direcção-Geral de Minas e Serviços Geológicos (Lisboa). Boletim de Minas. V. 6, No. 4, 1969, pp. 244–277.

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Pyrite and Sulfur.—The drop in production of pyrite in 1969 was reflected in exports, which declined by 35,000 tons compared with 1968. Exports of pyrite were valued at $2.9 million. Apparent domestic supply of pyrite was unchanged from the level of 1968 (292,000 tons), but imports of elemental sulfur rose by 25 percent to 26,000 tons. A sulfur recovery unit, with output capacity of 9,000 tons annually, was being installed in the new petroleum refinery at Matozinhos. A similar unit, with a production capacity of 8,000 tons annually, was already operating at the Cabo Ruivo refinery near Lisbon.

Mines d'Aljustrel S.A. was reportedly completing new port facilities for shipment of pyrites in the Setubal area. The company, which accounts for about 60 percent of Portugal's output of pyrite, was planning to increase production. Its pyrite reserves were reported to have increased to 130 million tons, of which an estimated 10 percent was at Aljustrel and 90 percent was about equally divided between the Moinho and Feitalis concessions. The only other producer of pyrite, Mines et Industries S.A., had an estimated 4 million tons of proved reserves at Louzal.

Additional pyrite reserves were apparently found in the Aljustrel region by Sociedade Mineira de Santiago, a subsidiary of Companhia União Fabril. By an agreement signed with the Government in 1969, the company plans to invest $12 million in exploration and development of mineral deposits in this region.

MINERAL FUELS

Coal and Coke.—The supply of coal declined rather sharply in 1969, when the drop in production was accompanied by a 26 percent reduction in imports as compared with 1968. The decline may have been largely due to reduced demand from the thermal power sector, as output of electricity from thermal plants was 50 percent less than in 1968. Consumption of coal for power generation had risen from 18,000 tons in 1966 to 311,000 tons in 1968.

Imports of coke rose to 329,000 tons, half of which came from West Germany.

Petroleum.—*Exploration.*—As many as 28 companies were reportedly interested in applying for offshore exploration concessions, but no awards were announced by yearend. Onshore exploration areas in the vicinity of Lisbon and in the western part of the Algarve region may be opened for concession, due to the limited financial resources of the present concessionaire, Cia. Portugesa de Petroleos (CPP). CPP is partly owned by the Government.

Imports, refining, and Consumption.—Imports of crude oil were up 12 percent, to more than 2 million tons in 1969, with Iraq and Bahrain the principal suppliers. A large increase was expected in 1970, as Portugal's second petroleum refinery came on stream in December. The new refinery, at Matozinhos, north of Porto, has a processing capacity of approximately 2 million tons of crude oil per year; its completion raises Portuguese refining capacity to 4 million tons annually, about 30 percent above the current level of domestic demand.

Refinery output and domestic consumption of petroleum products increased about 7 percent in 1969. Imports of refined products rose to 1.9 million tons, while consumption increased to 2.9 million tons. The share of oil in Portugal's energy needs was expected to exceed 70 percent by 1973.

A group of four oil-burning thermal powerplants, each with a generating capacity of 125 megawatts, was being built at the Carregado development near Lisbon. Two of the plants began operating in 1968; the others were scheduled for service in 1971 and 1973. Two additional units were planned.

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The Mineral Industry of Rumania

By Joseph B. Huvos [1]

Petroleum continued to be Rumania's most important contribution to world mineral supplies in 1969, and the nation's crude output ranked second among European producers. Production of 13.2 million tons was about 4 percent of the crude output of the U.S.S.R., and 0.62 percent of world production. Exploration yielded new crude oil reserves which could not quite compensate for the decline in reserves caused by intensive production in the existing fields.

Besides crude oil, Rumania produced manganese ore, cement, pyrites, and salt, each in quantities important only to the domestic economy.

The supply-demand situation for the more important minerals remained basically unchanged, while efforts were continued to develop the country's resources in accordance with goals set by the 5-year plan of 1965–70. Extensive exploration was carried out and the metal smelting and manufacturing base was further expanded, but the domestic metal output could not cover internal demand. In 1969, the mineral industry contributed about one-fifth of the social product[2] of the country. The most important developments in the minerals industry were the commissioning of the second stage expansion of the Slatina aluminum smelter, commissioning of a second blast furnace at the metallurgical combine in Galati, and commissioning of a lignite mine in Lupoiaia in the Motru Basin.

By world standards, Rumania's mineral commodity trade was modest, except for petroleum. Exports of petroleum products again exceeded 6 million tons. About 55 percent of all trade was with the U.S.S.R. and other Communist countries. The bulk of imports came from the U.S.S.R.

[1] Foreign mineral specialist, Bureau of Mines, Washington, D.C.

[2] As in other Communist countries of East Europe, Rumania does not report its gross national product (value of all final goods and services produced) but rather publishes a figure for the social product, which generally excludes all services and defense.

PRODUCTION

During 1969 crude oil production decreased slightly, as increasingly deeper structures had to be drilled for exploration. Increasing use was made of secondary recovery and of hydraulic fracturing techniques. Efforts to increase production were also continued in other areas of the minerals industry.

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Table 1.—Rumania: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1967	1968	1969 p
METALS				
Aluminum:				
Bauxite e		15,000	20,000	20,000
Metal and alloys		52,801	76,274	89,650
Copper, unwrought e		NA	5,000	5,000
Iron and steel:				
Iron ore	thousand tons	2,796	2,747	NA
Pig iron	do	2,456	2,992	3,477
Steel ingots and castings	do	4,088	4,751	5,540
Rolled products except pipe	do	2,908	3,393	3,816
Pipe	do	651	706	NA
Manganese ore (manganese content)		28,000	28,000	e 28,000
Lead (smelter) e		r 20,000	r 30,000	40,000
Silver e	thousand troy ounces	800	800	800
Zinc e		20,000	25,000	30,000
NONMETALS				
Barite e		55,000	55,000	55,000
Bentonite		110,000	120,000	NA
Cement	thousand tons	6,338	7,026	7,515
Fertilizers:				
Nitrogenous (nitrogen content)		372,262	420,714	720,000
Phosphatic (P_2O_5 content)		164,672	181,834	
Kaolin		50,000	e 50,000	e 50,000
Lime	thousand tons	1,050	1,050	e 1,050
Pyrites (gross weight) e	do	360	360	360
Salt	do	r 2,059	2,368	e 2,400
Sulfuric acid (monohydrate)	do	679	773	838
Talc	do	130	e 130	e 130
MINERAL FUELS AND RELATED MATERIALS				
Carbon black		52,473	54,873	56,423
Coal:				
Bituminous and anthracite	thousand tons	6,716	7,184	19,152
Lignite	do	7,647	9,146	
Brown	do	656	690	
Coke, metallurgical	do	1,131	1,133	NA
Natural gas [2]	million cubic feet	559,525	774,923	850,618
Petroleum:				
Crude	thousand tons	13,206	13,285	13,246
Refinery products:				
Gasoline	do	2,295	2,636	2,620
Kerosine	do	923	949	NA
Gas oil	do	4,025	4,368	4,693
Fuel oil	do	3,946	3,624	NA
Lubricants	do	r 535	584	NA
Asphalt	do	r 391	438	NA

e Estimate. p Preliminary. r Revised. NA Not available.

[1] In addition to listed commodities, Rumania produces antimony, chromite, molybdenum, asbestos, feldspar, gypsum, and mica, but quantitative data on production are not available.

[2] Includes associated gas.

TRADE

Official publications of Rumania did not report on mineral commodity trade by country of destination or origin, and only general trade information was available.

Rumania's principal trading partners were again the U.S.S.R. and other Communist countries, accounting for about 55 percent of all trade. Efforts continued to increase trade with non-Communist countries, in particular for the acquisition of advanced mining equipment and state-of-the-art processes. The bulk of exports consisted of petroleum products. The principal mineral commodities imported were crude oil, high-rank coals, and metallurgical coke. Mineral trade with the United States was again negligible. Iron ore, phosphate ore, and high-rank coal came mainly from the Soviet Union.

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Table 2.—Rumania: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Iron and steel:		
Steel ingots [1]	148,600	------
Slabs and rolled products	259,200	461,700
Pipe	243,700	219,900
Manganese ore	59,600	66,600
NONMETALS		
Barite [1]	19,700	10,800
Cement----thousand tons	1,369	1,208
Salt	396,500	484,700
MINERAL FUELS AND RELATED MATERIALS		
Bitumen, including natural	57,500	37,700
Carbon black	24,600	31,900
Natural gas, million cubic feet	7,000	8,048
Petroleum refinery products:		
Gasoline	957,300	988,700
Kerosine	215,400	180,200
Diesel oil---thousand tons	r 2,091	2,289
Fuel oil----do	1,790	1,678
Lubricants	371,300	357,700
Paraffin	24,700	22,200
Petroleum coke	45,500	41,300

r Revised.
[1] Official trade returns of the U.S.S.R. (imports from Rumania).

Source: Official trade returns of Rumania, unless otherwise noted.

Table 3.—Rumania: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite [1]	139,255	104,720
Alumina [1]	NA	5,389
Ingots [2]	400	NA
Semimanufactures [2] [3]	736	1,908
Copper:		
Unwrought [2]	4,100	4,300
Semimanufactures [2] [3]	1,678	1,763
Iron and steel:		
Iron ore----thousand tons	3,360	4,546
Pig iron [2]----do	384	503
Ferroalloys----do	69	76
Rolled products (except pipe) ----do	1,286	1,472
Pipe	98	80
NONMETALS		
Asbestos [2]	7,200	7,800
Cryolite [2]	500	500
Fertilizers:		
Apatite concentrate (P_2O_5 content)	219,600	205,600
Potassic fertilizers (K_2O content)	r 14,000	11,100
Nitrogenous fertilizers (N_2 content)	300	1,800
Refractories, all kinds [2]	16,800	18,800
Sulfur [2]	2,000	3,600
MINERAL FUELS AND RELATED MATERIALS		
Coal:		
Bituminous	793,200	671,700
Coke, metallurgical ----thousand tons	1,089	1,570
Petroleum refinery products:		
Lubricants [2]	400	600
All products [2]	700	1,400

r Revised. NA Not available.
[1] Official trade returns of Yugoslavia (exports to Rumania).
[2] Official trade returns of the U.S.S.R. (exports to Rumania).
[3] Including alloys.

Source: Official trade returns of Rumania, unless otherwise noted.

COMMODITY REVIEW

METALS

Aluminum.—In 1969, the second-stage expansion of the Slatina aluminum smelter was completed. This brought the capacity of the smelter to 75,000 tons per year. Work was underway on the third-stage expansion, which will bring capacity to 100,000 tons per year. Construction has started on a 400-kilovolt power line extending 114 miles from the Iron Gates hydroelectric powerplants to Slatina, to supply power mainly to the aluminum plant. At present the plant is fed by the Craiova thermal powerplant.

An industrial group for aluminum has been set up in Slatina to coordinate production and research at the Slatina aluminum plant, the Oradea alumina plant, and the Chemico-Metallurgical plant in Bucharest. The research institute for nonferrous and rare metals also comes under the jurisdiction of this newly formed group.

A new 20,000-ton-per-year wire mill has been installed at the Slatina aluminum plant.

Copper.—The Fagarul mine of the Bălan mining combine was completed in February 1969. It has been reported that the new mine will double the combine's ore production.

Iron and Steel.—In 1969, Rumania continued to develop its iron and steel industry. In October a second 1,700-cubic-meter blast

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furnace was commissioned at Galati. At present the combine is producing steelplate for ships, thus eliminating the corresponding imports. Installation has started also at Galati, on a new hot strip rolling mill, with a planned capacity of 2 million tons per year. A modern 280,000-ton-per-year wire rolling mill was commissioned at the Industria Sîrmei plant in Cîmpia Turzii.

Rumania has insufficient reserves of iron ore and coal, to supply the industry. In 1969, domestic output provided only 35 percent of the iron ore used, and by 1975 it will provide only 25 percent of the increased demand, while output of bituminous coal provided about nine-tenths of demand. The Soviet Union was furnishing two-thirds of the iron ore and about one-half of the bituminous coal imported.

About 1 million tons of iron ore is imported each year from India, and lesser quantities from Algeria and Brazil. Plans were made to form an international consortium to develop Guinean iron ore deposit on a common basis, the members being Australia, Italy, the United States, Rumania, and Yugoslavia. The capital would be $19 million for extracting 5 million tons of ore per year. Rumania and Hungary plan to share a 1-million-ton surplus of limonite ore, containing 50 percent iron, from the Ljubija mine in Yugoslavia. It was also reported in Rumania that new workings had been opened at the Poiana Roşie iron mine. The mine will supply 225,000 tons of ore per year to the iron and steel combine in Hunedoara, increasing its annual output by about 70,000 tons.

NONMETALS

Cement and Lime.—Construction of a building materials combine was started at Cîmpulung, in Arges County. Planned capacity is 2 million tons of cement and 200,000 tons of lime per year.

Fertilizers.—Construction was started on a second superphosphate plant at the chemical products plant in Valea Călugărească. Reportedly, the capacity is for an equivalent of 70,000 tons of P_2O_5, active material.

Preparations were made to start the construction of two nitrogen fertilizer plants in 1970, one in Piatra Neamt, the other in Tîrgu Mureş. The Piatra Neamt plant will produce ammonia, based on natural gas. The main contractor is the Salzgitter Industriebau GmbH of West Germany. The contract is valued at $17.5 million. The process originates with the firms of Foster Wheeler Française (Paris) and Ammoniaca Casale (Rome).

A contract was signed with the S.A. Coppée-Rust n.v. of Brussels for the construction of a 300,000-ton-per-year urea plant employing the Stamicarbon process at Slobozia.[3]

Kaolin.—A kaolin deposit estimated at 250,000 to 300,000 tons, at Harghita, was being readied for exploitation by expansion and modernization of the existing plant.

Sulfuric Acid.—The planned production level of 72,000-tons-per-year was reached at the Copşa Mica chemical and metallurgical plant in Sibiu County. Studies are being made on the possibility of increasing plant output to 100,000-tons-per-year using present equipment.

The Navodari sulfuric acid plant, near Constanta, went on stream. Design capacity is 200,000 tons of monohydrate per year.

Talc.—Plans were made to double the production of talc in 1970 at a mine situated in the Poiana Rusca massif. No production figures were given.

MINERAL FUELS

Coal.—In 1969, production of coal reached almost 20 million tons. According to plans, 36 to 38 million tons of coal is to be extracted annually by 1975, of which about 10 million tons will be mined by opencast methods. Proved and probable coal reserves were estimated to be 3 billion tons, sufficient for 150 years at present production rates. The most important coal district lies in the Jiu Valley in the southern Carpathian Mountains, where over half of the coal is produced. The coal is a long-flame gas coal with 7 percent moisture and 35 percent ash. It has poor coking properties but produces satisfactory metallurgical coke if blended with other domestic or imported coals.

In the Rovinari basin, work started on the second stage of diverting the flow of the Jiu River, between Vladuleni and Roşia

[3] Oil and Gas Journal. V. 9, No. 8, August 1969, p. 110.

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de Jiu in a new 4½-mile-long canal. This brings canal length to 10 miles and total canal length in the area to 25 miles, making accessible more than 150 million tons of coal.

The Barbateni coal mine was linked by a gallery to the Lupeni coal mine. The Barbateni mine is to produce 50,000 tons of coal in 1970.

In the Motru basin in Gorj County, a lignite mine was commissioned in Lupoaia. Design capacity was 70,000 tons per year.

It was reported that bituminous coal sufficient to feed a 600-megawatt power-plant for 60 to 80 years was discovered in the Anina area of Caraş-Severin County.

Petroleum and Natural Gas.—In 1969, Rumania, as in recent years, produced more oil and natural gas than it consumed. About one-half of its production was sufficient to cover domestic demand; the remainder was exported in the form of products. To use its excess refining capacity, Rumania imported increasing quantities of crude oil. In 1969–70, crude imports from Saudi Arabia will be 14 million tons.[4]

Crude production in 1969 was down slightly to 13,246 thousand tons. Natural gas production increased almost 10 percent to 851 billion cubic feet. The plans are to increase secondary recovery operations and deep drilling. Almost 30 percent of crude production reportedly came from Clejani in the Videle district.

Oil reserves of Rumania were estimated to be 200 million tons. Reserves of natural gas were estimated to be 8,827 billion cubic feet.

During 1966–70, about 11 percent of industrial development funds were to go for geological prospecting and exploratory drilling for oil and gas; 29.5 million feet was to be drilled, one-half of it as exploratory drilling. Most of the ultra-deep drilling has been in the Prahova Valley region, in the Ploieşti area; the deepest hole (20,340 feet) at present is at Ghergeasa in the Buzau area.

During 1969, several petrochemical projects were in the news; among others, construction was started on a 6,000-ton-per-year maleic anhydride plant in Ploieşti; in Piteşti, a 20,000-ton-per-year acrylonitrile plant was commissioned.

[4] World Oil. V. 160, No. 3, Aug. 15, 1969, p. 110.

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The Mineral Industry of Sierra Leone

By E. Shekarchi [1]

The diamond industry is Sierra Leone's largest foreign exchange earner. In 1964–68, the diamond industry accounted for 60 to 65 percent of total exports. In 1969, a record year, the value of diamond exports was about $69.4 million,[2] constituting 69 percent of total exports. The industry provides about 20 percent of the Government's total revenue, and approximately 50,000 persons earn their livelihood from it. Bauxite, iron ore, and titanium minerals are becoming foreign exchange earners as well.

It was announced in the Sierra Leone Gazette on December 18, 1969, that mining companies operating within the country should provide the Government of Sierra Leone with a reasonable share of the profits and an informed voice in each company's future plans. Within the first quarter of 1970, the Government expected to finalize arrangements for the purchase of a majority ownership interest in each mining company.

The following basic principles were to be applied:

1. "Payment shall be made out of future dividends, the valuation of each share of stock acquired to approximate its book value in the light of the company's profitability, capital investment in Sierra Leone and depreciation of assets. The Government will appoint a majority number of the directors of each company and day-to-day managerial operation shall be a subject for negotiations. The Government's share shall be held by a new Government-owned corporation.

2. "The Government shall, by means of taxation and dividends, share in all profits directly or indirectly generated to the fullest extent required by a careful evaluation of profitability, fair return, past and future investment decisions, and foreign tax credits. The Government, once its stock in a company has been paid for, will adjust downward the effective tax rate applicable to each company to offset the revenues realized through its ownership interest.

3. "The Government shall formulate, with each mining company, an explicit plan for the co-ordinated long-range development of the Sierra Leone economy; including the establishment of new industrial and agricultural enterprises, a reduction in the proportion of expatriate staff and an increase in the pace at which Sierra Leoneans are being trained for, and placed in, managerial, technical and professional positions by the mining companies, the improvement of social services and rehabilitation of abandoned lands which were sites of former mines."

PRODUCTION AND TRADE

The mineral sector remained limited to production of bauxite, iron ore, titanium minerals, and diamonds. Reported preliminary production figures showed an overall increase for 1969 over 1968 output. The most notable increases were: Bauxite, 24,000 tons; iron ore, 500,000 tons; and titanium minerals, 9,000 tons.

Available information on mineral trade of Sierra Leone for the years 1966 and 1967 is shown in tables 2 and 3.

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[1] Foreign mineral specialist, Bureau of Mines, Washington, D.C.

[2] Where necessary, values have been converted from Leones (Le) to U.S. dollars at the rate of Le1=US$1.20.

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Table 1.—Sierra Leone: Production of mineral commodities

Commodity		1967	1968	1969 p
METALS				
Bauxite	thousand metric tons	342	r 421	445
Iron ore	do	2,098	r 2,500	e 3,000
Titanium minerals	metric tons	25,141	26,000	e 35,000
NONMETALS				
Diamond:				
Gem e	thousand carats	560	560	600
Industrial e	do	r 878	r 962	1,337
Total	do	r 1,438	r 1,522	1,937

e Estimate. p Preliminary. r Revised.

Table 2.—Sierra Leone: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1966	1967
METALS			
Bauxite	thousand metric tons	244	334
Iron ore:			
Concentrate	do	2,110	2,094
Fines	do	107	56
Total	do	2,217	2,150
Ferromax [1]		1,157	837
Iron and steel scrap		NA	1,028
Nonferrous metal scrap		NA	61
NONMETALS			
Diamond, crude, unworked	thousand carats	1,338	1,160

NA Not available.
[1] Trade name for specularite, largely for pigment use.

Table 3.—Sierra Leone: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1966	1967
METALS			
Aluminum		171	167
Copper		693	29
Iron and steel, semimanufactures		18,840	20,469
Lead		45	63
Silver	troy ounces	2,149	------
Tin	long tons	1,221	1,036
Zinc		2	18
Nonferrous metals, n.e.s.		7	2
NONMETALS			
Abrasives		------	101
Cement and lime		34,907	12,933
Clay construction materials		319	230
Fertilizer materials:			
Natural		31	85
Manufactured		2,782	1,204
Salt		10,003	9,441
Sodium hydroxide		566	116
Stone, sand and gravel		42,108	42,723
Stone, dimension		NA	102
Tar, mineral		121	143
Nonmetallic minerals, n.e.s.		132	41
MINERAL FUELS AND RELATED MATERIALS			
Coal, coke, briquets		NA	21,584
Gas, natural and manufactured (butane)		231	276
Petroleum, refinery products:			
Gasoline	thousand 42-gallon barrels	228	193
Kerosine	do	80	116
Jet fuel	do	24	17
Distillate fuel oil	do	1,103	978
Residual fuel oil	do	67	94
Lubricating oils	do	23	23
Asphalt and others	do	17	22
Total	do	1,542	1,443

NA Not available.

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COMMODITY REVIEW

METALS

Bauxite.—Sierra Leone Ore and Metal Co. Ltd., a subsidiary of Suisse Aluminium Industrie A.G., continued its upward trend in production in 1969. No details of the expansion plan or progress made were available, but it was reported that the expansion plan envisages mine capacity that will double the present production.

Iron Ore.—The first phase of enlargement and dredging of the port of Pepel in Sierra Leone, where most of Marampa iron ore is exported, was completed on schedule in 1969. The second phase of the expansion is a major modification of the Marampa plant to handle more ore. However, because of delays in equipment deliveries, this phase of expansion will not take place until late in 1970.

Titanium Minerals.—Sherbro Minerals Ltd,. jointly owned by British Titan Products Ltd. and PPG Industries, Inc., continued modification of its plant to bring ore production to a rated capacity of 100,000 tons. It is anticipated that these modifications will provide a significant increase in feed to the wet separation plant and more efficiency in ore recovery due to a substantial cut in sands lost. The full rated capacity is expected to be achieved in 1970.

NONMETALS

Diamond.—Output in 1969 apparently increased substantially in both quantity and value. The increase was primarily attributed to the activities of three producing groups.

Sierra Leone's Selection Trust (SLST), which uses modern techniques of production, mines both gem and industrial diamonds. The company operates in two fields, Kano and Tonga. Kano covers 311 square miles and includes the company headquarters; Tonga is 80 miles south of Kano. Apparently new investments are being made to raise the company's production level to 800,000 carats by the end of 1970.

A group which mines under the Alluvial Diamond Mining Scheme has been authorized by the Government to produce diamonds in an area of approximately 9,000 square miles. About 2,200 permits were issued by the Government to the group. Each digger is limited to work about 4 acres.

Apparently a third group, whose output is unknown, operates and produces without Government permission; it is understood that the Government eventually will stop the operation.

The production figure given in table 1 is the total known output of the two groups. On the basis of known geological conditions, diamond production in Sierra Leone will probably increase for some time.

MINERAL FUELS

Petroleum.—The Sierra Leone oil refinery was completed on schedule but remained idle for 6 weeks while the Government and private partners negotiated over its management. It began operation in February 1969, providing employment for 110 persons. It is expected to process 10,000 barrels per day of crude oil and produce regular and premium-grade gasoline, jet fuel, kerosine, diesel fuel, and fuel for bunkers. Shareholders are British Petroleum Ltd., 7 percent; the Sierra Leone Government, 50 percent; Shell Oil Corp., 16 percent; Mobil Oil Corp., 11 percent; Texaco Inc., 11 percent; and Agip Inc., 5 percent. British Petroleum Ltd. will manage the refinery.

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The Mineral Industry of the Republic of South Africa

By Walter C. Woodmansee [1] and Roderick G. Murchison [2]

During 1969 the South African mineral industry maintained a steady growth rate in most sectors. In the mining sector, expansion was underway for antimony, gold, iron, platinum, tin, uranium, coal, diamond, phosphate, pyrite (for sulfuric acid), and vermiculite.

In the metallurgical sector, the Republic's first aluminum smelter was under construction at Richards Bay. The Government-owned South African Iron and Steel Industrial Corp. (ISCOR) continued expansion programs at its two steelworks (Vanderbijlpark and Pretoria) and announced plans for a third major steelworks at Newcastle. Capacity for ferroalloys, particularly ferrochrome, also was under expansion by a number of companies. Rustenburg Platinum Mines Ltd. (RPM) opened its platinum refinery at Wadeville. Impala Platinum Mines Ltd. also started refinery production of platinum. Nickel and copper are important byproducts of these operations. Other companies also are involved in platinum development. Several gold-mining companies planned to reopen uranium-processing facilities. South Africa's first zinc refinery opened in April.

In the nonmetals sector, most cement companies were involved in expansion programs, and the fertilizer and chemical industries were attempting to increase production to meet a continuing high demand for these materials.

In the fuels sector, the Electricity Supply Commission announced a 12-year expansion program for the generation of electricity at coal-burning thermal powerplants and at nuclear plants. Offshore petroleum exploration was started and, in March, Superior Oil Co. Ltd., operator for a consortium, announced a significant natural gas discovery in its first offshore well. A new crude oil pipeline from the coast to the Witwatersrand industrial area was on stream in June. New mooring and crude oil storage facilities were under construction at Reunion, near Durban, for supplying two Durban refineries. Existing refineries were undergoing expansion, and construction started on a new refinery at Sasolburg.

A shortage of labor, both skilled and unskilled, continued as a serious problem in the mineral industry throughout the year. Recruitment of African labor was well below requirements although there was an increase of more than 5 percent in workers from outside the Republic. The turnover among these Africans from neighboring countries, however, is generally higher than among indigenous workers. In December, there was a deficit of 30,000 African laborers below requirements. In addition, a serious shortage of white miners and qualified technical staff existed. The general industrial shortage of skilled manpower was largely responsible for a further decline in white miners in the gold mines—a loss of 800 during the year—and the existing shortage of 1,500 white mine workers.[3] The decline in skilled labor was to some extent offset by higher productivity, mainly the result of improved planning, increased mechanization, and more effective utilization of both white and black labor.

Efficient and economic movement of ores

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[3] South African Chamber of Mines. Preliminary Statistics for 1969. Johannesburg, June 1970.

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and processed minerals to domestic markets and to ports also was problematical. Shortages of rail cars and lines delayed ore deliveries, threatened contracts, and adversely affected mine planning and development. Long-term solutions were proposed by both industry and Government. Industry proposed that South African Railways and Harbors (SAR), the Government transport monopoly and the country's largest single commercial undertaking, permit the establishment of private rail links by the mining companies. The SAR suggested that industry consider providing financial assistance for extra rail services needed for bulk exports.

Late in 1968, United States Steel Corp. secured a 31-percent interest in Feralloys Ltd. after concluding an agreement with Associated Manganese Mines of South Africa Ltd., a member of the Anglo Transvaal Consolidated Investment Co. Ltd. (Anglovaal) group. In 1969 United States Steel provided a $7.5 million loan for a 15-percent interest in three Anglovaal projects—platinum at Middelpunt, copper-zinc-pyrite at Prieska, and prospects in Botswana and South-West Africa. A new holding company—Africa Triangle Mining, Prospecting, and Development Co. (Pty.) Ltd.—was established. According to terms of the agreement, United States Steel may advance another $7.5 million and acquire an additional 15-percent interest in 1970.[4]

PRODUCTION

Most mineral commodities showed increases in output during 1969. The most notable increases were in metallurgical chromium and manganese ores, nickel, platinum, fluorspar, sheet mica, vermiculite, and phosphate rock. Another record was attained in gold production, although output was only slightly higher than in 1968. Increasing quantities of sulfur are recovered at petroleum refineries. Refined slab zinc and vanadium-bearing slag were produced and marketed for the first time. Ilmenite and rutile mines were re-opened, having been closed since 1963.

Total value of mineral production was not reported but can be estimated from domestic sales and export values reported by the South African Department of Mines. On this basis the mining sector contributed $2.1 billion[5] to a gross national product (GNP) estimated at $15.9 billion by the South African Reserve Bank. Gold accounted for nearly 56 percent of this total. Exclusive of platinum and uranium, for which data were not available, copper, diamond, and coal were other leading commodities.

On the basis of official production indices, total output of the metal industries increased 9 percent to $2,660 million in 1969.[6]

[4] Engineering and Mining Journal. V. 170, No. 8, August 1969, p. 166.
[5] Where necessary, values have been converted from South African Rands (R) to U.S. dollars at the rate of R1=US$1.40.
[6] South African Mining and Engineering Journal. V. 81, No. 4016, Jan. 25, 1970, pp. 176–178.

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Table 1.—Republic of South Africa: Production of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Aluminum, unwrought and semimanufactures	9,454	8,867	•9,000
Antimony, concentrate	20,159	27,372	29,615
Beryllium, beryl concentrate, 11 to 12 percent BeO	104	308	313
Bismuth, concentrate kilograms	54	3,629	18
Chromium, chromite, gross weight:			
More than 48 percent Cr_2O_3	35,178	69,485	102,810
44 to 48 percent Cr_2O_3	781,270	758,477	800,760
Less than 44 percent Cr_2O_3	332,607	324,768	294,098
Total	1,149,055	1,152,730	1,197,668
Copper:			
Mine, content of ore •	150,000	146,000	148,000
Metal:			
Blister and refined	127,535	128,232	126,185
Castings, including alloys	48,928	30,829	•40,000
Gold, metal, primary thousand troy ounces	30,535	31,169	31,276
Iron and steel:			
Iron ore and concentrate thousand tons	7,737	8,233	8,788
Pig iron do	3,429	3,775	3,981
Ferroalloys do	360	349	424
Steel:			
Ingots and castings do	r3,995	r4,308	4,829
Semimanufactures do	r2,297	r2,423	•2,500
Lead, metal content of ore	24	---	---
Manganese, ore and concentrate, gross weight:			
Metallurgical:			
More than 48 percent Mn	183,008	259,840	517,662
45 to 48 percent Mn	290,972	177,190	182,100
40 to 45 percent Mn	191,181	180,578	156,404
30 to 40 percent Mn	1,089,447	1,263,629	1,330,169
Subtotal	1,754,608	1,881,237	2,186,335
Chemical:			
More than 65 percent MnO_2	5,706	13,451	14,254
Less than 65 percent MnO_2	56,337	77,024	53,508
Subtotal	62,043	90,475	67,762
Total	1,816,651	1,971,712	2,204,097
Low grade, 15 to 30 percent Mn, 20 to 35 percent Fe	284,433	455,480	439,115
Nickel, metal, electrolytic •	5,400	5,500	10,000
Platinum-group metals:			
Osmiridium from gold ores (sales) • troy ounces	7,000	14,000	14,000
Content of concentrates, matte, and refinery products • thousand troy ounces	825	850	950
Silver, metal, primary do	3,064	3,337	3,335
Tantalum-columbium, concentrate	5	18	4
Tin:			
Concentrate, gross weight long tons	2,829	2,897	2,979
Concentrate, metal content do	1,764	1,837	1,847
Metal, primary do	658	686	738
Titanium minerals:			
Ilmenite	---	---	16,505
Rutile	---	---	493
Tungsten, concentrate, 60 percent WO_3, gross weight	25	48	61
Uranium, oxide (U_3O_8) [r]	2,915	3,522	3,610
Vanadium, oxide (V_2O_5) [1]	3,425	3,126	4,630
Zinc	---	---	11,845
Nonferrous metals, n.e.s., mainly semimanufactures •	45,400	46,000	46,000
NONMETALS			
Asbestos:			
Amosite	86,090	88,225	89,948
Chrysotile	35,649	38,592	43,556
Crocidolite	121,824	109,533	124,669
Total	243,563	236,350	258,173
Barite	1,493	519	3,513
Cement thousand tons	4,012	4,410	4,987
Clays:			
Bentonite	15,162	12,652	14,503
Fire clay	218,563	179,590	220,011
Flint clay	150,985	196,612	196,626
Fuller's earth	1,149	215	1,130
Kaolin	32,834	32,711	33,159
Corundum, natural	318	256	229
Diamond, gem and industrial thousand carats	6,668	7,433	7,863
Diatomite	585	624	513
Feldspar	24,891	19,888	22,036

See footnotes at end of table.

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Table 1.—Republic of South Africa: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
NONMETALS—Continued			
Fertilizer materials:			
Crude (natural), phosphate rock, beneficiated..thousand tons..	1,852	1,565	1,679
Manufactured:			
Phosphatic.....do....	r 997	911	e 950
Mixed.....do....	r 815	900	e 900
Fluorspar:			
Acid grade	33,799	40,524	55,728
Ceramic grade	4,188	2,896	4,503
Metallurgical grade	57,320	65,140	90,044
Total	95,307	108,560	150,275
Gem stones, semiprecious:			
Emerald.....kilograms..	377	928	1,382
Tiger's eye [2]	404	148	63
Graphite, all grades	671	723	458
Gypsum, crude	307,592	316,050	359,420
Kyanite and related materials:			
Andalusite	24,583	22,444	42,450
Sillimanite	35,385	33,195	28,297
Lithium minerals	------	36	35
Magnesite, crude	80,012	59,797	48,121
Mica:			
Sheet.....kilograms..	4,232	9,247	99,894
Waste	4,618	7,918	6,349
Pigments, natural mineral	8,632	3,894	3,511
Pyrite:			
Noncupriferous, gross weight	552,743	587,564	589,024
Cupriferous, gross weight	315,919	116,792	248,307
Quartz, quartzite, and glass sand [3]	422,502	455,931	505,623
Salt.....thousand tons..	317	342	3[illegible]
Stone, sand and gravel:			
Dimension stone:			
Calcareous, marble	11,423	18,852	22,8[illegible]
Wonderstone (pyrophyllite)	4,618	5,094	4,700
Crushed and broken:			
Lime and limestone.....thousand tons..	11,830	12,891	13,928
Shale.....do....	242	246	252
Sulfur e	6,000	6,000	12,000
Talc	9,136	9,052	8,812
Vermiculite	101,501	110,180	128,787
MINERAL FUELS AND RELATED MATERIALS			
Carbon black e.....thousand tons..	32	32	32
Coal:			
Anthracite.....do....	1,280	1,365	1,541
Bituminous.....do....	48,021	50,289	51,211
Total.....do....	49,301	51,654	52,752
Coke:			
Oven and beehive e.....do....	3,000	3,200	3,400
Gashouse, low and medium temperature e.....do....	175	175	175
Petroleum refinery products:			
Gasoline.....thousand 42-gallon barrels..	16,376	15,691	17,265
Kerosine and jet fuel.....do....	2,125	1,480	1,698
Distillate fuel oil.....do....	13,586	12,758	13,177
Residual fuel oil.....do....	14,677	15,652	13,992
Other.....do....	2,473	2,386	2,870
Total.....do....	49,237	47,967	49,002

e Estimate. r Revised.

[1] Does not include vanadium in slag, production of which began in 1968.

[2] Decorative material resulting from oxidation and silicification of crocidolite.

[3] Includes silcrete, a rock containing up to 98 percent silica.

TRADE

During 1968, the latest year for which complete data are available from the South African Department of Customs and Excise, metal and mineral exports were higher compared with 1967. Total value of these exports, including only those commodities listed in table 2, was $916 million ($855 million in 1967), about 43 percent of total exports of $2,110 million. Principal mineral commodity exports were gem diamond, $266.7 million; copper, $164.1 million; iron and steel (including iron ore

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and ferroalloys), $145 million; petroleum refinery products, $98.3 million; asbestos, $46.5 million; industrial diamond, $39 million; and manganese ore, $27.5 million.

Mineral commodity imports, including only those commodities listed in table 3, comprised $376 million in 1968, 14 percent of total imports of $2,638 million. Principal mineral imports were petroleum, $172 million, including $86.3 million for crude oil; iron and steel, $73.5 million; gem and industrial diamond, $24.2 million; aluminum, $19.8 million; copper, $14.8 million; and sulfur, $9.7 million.

Table 2.—Republic of South Africa: Exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum:			
Oxide and hydroxide	17	39	NA.
Metal, including alloys:			
Scrap	1,405	2,205	Japan 579; Belgium 574; West Germany 457.
Unwrought and semimanufactures	1,419	1,877	NA.
Antimony, ore and concentrate	20,585	25,342	United Kingdom 15,808; United States 7,235.
Arsenic, oxides and acids	899	1,095	United States 941.
Chromium:			
Chromite	656,900	816,677	United States 358,073; West Germany 138,947; Japan 134,752.
Oxide and hydroxide	213	31	NA.
Copper:			
Ore and concentrate	7,737	10,418	Japan 10,080.
Matte	41	55	All to West Germany.
Metal, including alloys:			
Scrap	411	561	Netherlands 128; West Germany 127.
Unwrought:			
Blister and other unrefined [2]	68,627	73,697	United States 27,158; Japan 22,956.
Refined [2]	79,036	69,179	West Germany 35,413; United Kingdom 17,580.
Semimanufactures	5,427	8,661	United States 4,443; West Germany 1,407.
Gold, metal, unworked or partly worked troy ounces	13,839	970	NA.
Iron and steel:			
Ore and concentrate [3] thousand tons	4,269	4,476	Mostly to Japan.
Roasted pyrite	2,172	191	NA.
Metal:			
Scrap	5,906	8,150	Japan 3,352.
Pig iron	933,546	829,503	Japan 776,344.
Powder and shot	217	174	NA.
Spiegeleisen	2,106	925	Italy 783.
Ferroalloys:			
Ferromanganese	127,834	129,612	United States 43,514; United Kingdom 29,631; Canada 17,058.
Ferrochrome	90,340	75,905	United States 23,959; West Germany 18,692.
Ferrosilicon	26,979	16,883	Australia 4,798; Japan 3,559.
Other	2,361	2,196	Australia 1,076; United Kingdom 662.
Ingots and other primary forms	805	15,996	Spain 9,390.
Semimanufactures:			
Bars and rods	24,921	29,310	NA.
Angles, shapes and sections	24,066	26,669	NA.
Plate and sheet	118,780	142,141	Greece 50,971.
Hoop and strip	3,439	2,807	NA.
Rails and accessories	24,660	38,316	NA.
Wire and wire rod	6,709	7,420	NA.
Tubes, pipes, and fittings	24,952	25,952	NA.
Castings and forgings	810	729	United Kingdom 141; United States 102.
Total	228,337	273,344	
Lead: [3]			
Concentrate, with vanadium	4,429	6,514	All to West Germany.
Oxide	93	82	NA.
Metal, including alloys:			
Unwrought	65,589	48,905	Italy 13,576; United Kingdom 13,231.
Semimanufactures	51	234	NA.
Magnesium, metal, including alloys:			
Scrap	57	88	United States 56.
Unwrought and semimanufactures	1	2	NA.
Manganese:			
Ore and concentrate thousand tons	1,354	1,768	Netherlands 641; Japan 377; France 260; United Kingdom 171.
Oxide	10	31	NA.
Metal, electrolytic	7,994	8,044	United States 2,550; Canada 1,899.
Mercury 76-pound flasks	15	7	NA.

See footnotes at end of table.

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Table 2.—Republic of South Africa: Exports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS—Continued			
Nickel:			
Ore and concentrate	5	4	NA.
Matte, speiss, and similar materials	78	199	Mostly to Canada.
Metal, including alloys:			
Scrap	63	48	NA.
Unwrought	8,573	8,732	West Germany 6,583.
Semimanufactures	107	12	NA.
Platinum-group, metals, including alloys, all forms e thousand troy ounces	800	800	NA.
Silver:			
Ore and concentrate value, thousands	$3,072	$4,447	All to United States.
Waste and sweepings troy ounces	463	21,541	United Kingdom 19,504.
Metal, including alloys thousand troy ounces	11,176	4,109	United Kingdom 2,982; United States 866.
Tin:			
Ore and concentrate long tons	2,498	2,522	United Kingdom 1,315; Netherlands 1,205.
Metal:			
Scrap do	156	458	Netherlands 399.
Unwrought and semimanufactures do	57	162	NA.
Titanium, oxide	59	62	NA.
Tungsten:			
Ore and concentrate	57	67	United Kingdom 35; West Germany 16.
Metal, including alloys, all forms	10	15	NA.
Vanadium, pentoxide, fused	2,750	3,701	Austria 1,336; Japan 697.
Zinc: [3]			
Ore and concentrate	39,453	36,385	United Kingdom 19,039; United States 11,222.
Oxide	159	217	NA.
Metal, including alloys:			
Scrap, dust and powder	72	83	NA.
Unwrought and semimanufactures	73	37	NA.
Other:			
Ore and concentrate:			
Titanium, vanadium, other	137	190	West Germany 175.
Base metals, n.e.s.	3,840	2,850	United Kingdom 1,495; United States 746.
Ash and residue containing nonferrous metals	819	538	Spain 406.
Base metals, n.e.s.	259	383	United Kingdom 275.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	5	6	NA.
Grinding and polishing wheels and stones	181	200	NA.
Asbestos	234,020	258,744	United Kingdom 62,618; United States 34,588; Japan 33,439; Italy 20,603.
Barite	63	144	NA.
Cement	78,043	60,054	NA.
Chalk	12	7	NA.
Clays and clay products:			
Crude clays, n.e.s.	138,692	170,050	West Germany 67,290; Japan 54,318.
Kyanite and sillimanite	45,042	39,548	Japan 21,028; West Germany 6,407; United Kingdom 6,280.
Products:			
Refractory	20,236	29,804	NA.
Nonrefractory	5,939	12,637	NA.
Diamond:			
Gem, unworked and worked thousand carats	2,962	3,439	United Kingdom 3,112.
Industrial:			
Natural do	19,799	7,466	United Kingdom 5,098; Ireland 2,229.
Manufactured do	1,972	2,799	Ireland 2,740.
Diatomite	421	305	NA.
Feldspar	7,163	8,328	West Germany 4,377; Italy 1,760.
Fertilizer materials:			
Crude:			
Natural nitrate	-------	54	NA.
Phosphate rock	973	1,616	NA.
Manufactured:			
Nitrogenous	56,600	27,183	NA.
Phosphatic	2,192	7,015	NA.
Potassic	436	1,066	NA.
Other, including mixed	19,263	64,740	NA.
Ammonia	614	2,978	NA.
Fluorspar	90,064	87,501	Japan 71,634.
Graphite, natural	54	44	NA.
Gypsum and plasters	9,616	16,608	NA.
Lime	4,692	3,380	NA.
Magnesite	6,378	2,345	United Kingdom 947.

See footnotes at end of table.

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Table 2.—Republic of South Africa: Exports of mineral commodities [1]—Continued
(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
NONMETALS—Continued			
Mica:			
Crude, including splittings and waste	7,028	10,623	United Kingdom 7,328.
Worked, including agglomerated splittings, value, thousands	-------	$24	United States $20.
Pigments, mineral:			
Natural, crude	2,062	2,047	United Kingdom 1,759.
Iron oxides, processed	216	244	NA.
Precious and semprecious stones, except diamonds:			
Precious, thousand carats	1,635	2,615	Switzerland 2,553.
Semiprecious, kilograms	403,296	334,007	United States 103,795; Japan 80,610; West Germany 60,115.
Salt	30,519	42,508	NA.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	41	174	NA.
Caustic potash	-------	19	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	893	2,832	United States 2,443.
Granite	144,290	174,279	France 45,109; West Germany 39,127; Netherlands 19,186.
Slate	64	122	NA.
Worked, including slate	103	149	NA.
Dolomite, chiefly refractory grade	11,879	11,037	NA.
Gravel and crushed rock	1,004	1,121	United Kingdom 611.
Limestone, except dimension	3,705	7,747	NA.
Quartz and quartzite	817	1,352	United States 525; Netherlands 319.
Sand, excluding metal bearing	3,404	2,051	NA.
Sulfur:			
Elemental:			
Other than colloidal	5,060	11,010	NA.
Colloidal	13	121	NA.
Sulfuric acid	615	377	NA.
Talc and steatite	376	330	Sweden 452.
Vermiculite	95,819	96,208	United Kingdom 25,170; Italy 18,292; West Germany 11,846; United States 9,594.
Nonmetals, n.e.s.:			
Crude	1,405	3,941	Netherlands 1,154; United Kingdom 1,019.
Slag, dross, and similar waste (not metal bearing) from iron and steel manufacture	4,299	14,638	NA.
Building materials of asphalt, asbestos, and fiber cement and unfired nonmetals, n.e.s	9,842	7,593	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	28	68	NA.
Carbon black and gas carbon	1,333	1,808	NA.
Coal and briquets:			
Anthracite	650,098	626,921	Japan 420,411; Italy 134,268.
Other	606,443	607,714	NA.
Coke and semicoke	1,326	31,866	Japan 21,514.
Gas, hydrocarbon:			
Natural	2,369	2,542	NA.
Manufactured	532	11,530	NA.
Petroleum refinery products:			
Gasoline, thousand 42-gallon barrels	633	542	NA.
Kerosine and jet fuel, do	594	557	Ships' stores 334.
Distillate fuel oil, do	2,566	2,048	Ships' stores 1,253.
Residual fuel oil, do	15,917	21,010	Ships' stores 20,743.
Lubricants, do	283	418	NA.
Mineral jelly and wax, do	85	93	United States 47; West Germany 19.
Other:			
Nonlubricating oils, do	r 4	6	NA.
Pitch and pitch coke	54	-------	
Bitumen and other residues	7,152	10,347	NA.
Bituminous mixtures, n.e.s	10,517	5,260	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	2,243	6,423	NA.

e Estimate. r Revised. NA Not available.
[1] Source: Foreign Trade Statistics. Volume I, 1968, compiled by the Department of Customs and Excise, and includes Botswana, Lesotho, Swaziland, and the Territory of South-West Africa.
[2] Partially or wholly from Botswana, Lesotho, Swaziland, or South-West Africa.

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Table 3.—Republic of South Africa: Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum:			
Bauxite	8,443	12,252	French Guiana 4,161.
Oxide and hydroxide	696	918	West Germany 520; United States 177.
Metal, including alloys:			
Scrap	137	132	Switzerland 88.
Unwrought	17,639	24,208	Canada 20,158.
Semimanufactures	10,083	8,575	Canada 2,369; United Kingdom 2,268.
Arsenic, trioxide, pentoxide, and acids	522	40	NA.
Chromium:			
Chromite	29,874	23,109	NA.
Oxide and hydroxide	70	107	United States 37.
Cobalt, oxide and hydroxide	8	14	Mostly from Canada.
Copper:			
Ore and concentrate	8,412	59,083	NA.
Metal, including alloys:			
Scrap	76	124	NA.
Unwrought, mainly refined	32,752	6,579	NA.
Semimanufactures	4,258	3,627	United Kingdom 1,481; Italy 549.
Gold, metal, unworked or partly worked troy ounces	22,675	28,638	United Kingdom 16,711; West Germany 6,545.
Iron and steel:			
Ore and concentrate	14	119	All from United Kingdom.
Metal:			
Scrap	9,519	18,689	NA.
Pig iron, ferroalloys, and similar materials	93,594	157,398	NA.
Steel, ingots and other primary forms	89,058	82,323	West Germany 26,507.
Semimanufactures:			
Bars and rods	10,758	13,996	United Kingdom 7,866; West Germany 1,785.
Angles, shapes, and sections	10,636	7,617	United Kingdom 3,585; Belgium 2,840.
Plate and sheet	264,669	106,835	United Kingdom 37,751; Japan 21,498; Australia 18,776.
Hoop and strip	3,979	4,128	United Kingdom 1,333; Japan 1,066.
Rails and accessories	7,777	13,818	United Kingdom 6,409.
Wire and wire rod	16,782	11,151	Belgium 4,507; United Kingdom 2,120.
Tubes, pipes, and fittings	24,115	90,775	West Germany 47,301; United Kingdom 21,986.
Castings and forgings, rough	4,209	4,879	Australia 1,775; France 1,428.
Total	342,920	253,199	
Lead:			
Oxides	85	113	NA.
Metal, including alloys:			
Scrap	3,189	4,838	Australia 1,621; New Zealand 598.
Unwrought	5,499	4,724	NA.
Semimanufactures	1,309	2,785	NA.
Magnesium, metal, including alloys, all forms	353	229	Norway 191.
Manganese:			
Ore and concentrate	426	389	Netherlands 110; Japan 40.
Oxides	1,119	1,536	United Kingdom 1,327.
Mercury 76-pound flasks	1,125	1,233	Spain 460; Italy 254; United Kingdom 161.
Molybdenum, metal, including alloys, all forms	5	12	United States 3; United Kingdom 3.
Nickel, metal, including alloys, all forms	426	474	United Kingdom 266.
Platinum-group metals, including alloys, all forms troy ounces	3,715	6,668	United Kingdom 5,898.
Silver:			
Waste and sweepings do.	1,543	782	NA.
Metal, including alloys do.	165,463	224,191	Switzerland 74,244; West Germany 53,293; United Kingdom 35,396.
Tin:			
Ore and concentrate long tons	1	35	United States 14.
Oxide do.	13	19	United Kingdom 10.
Metal:			
Scrap do.	5	-------	
Unwrought and semimanufactures do.	547	395	NA.
Titanium, oxide	162	409	West Germany 234; United Kingdom 138.
Tungsten:			
Ore and concentrate	795	292	Australia 89; Portugal 25.
Metal, including alloys, all forms	42	87	NA.

See footnotes at end of table.

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Table 3.—Republic of South Africa: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS—Continued			
Zinc:			
Ore and concentrate	5	24,018	Australia 13,501; Italy 10,514.
Oxide	188	271	United States 88; Netherlands 69.
Metal, including alloys:			
Scrap, including powder and dust	1,094	1,339	Australia 313; United States 178.
Unwrought	49,098	38,904	NA.
Semimanufactures	996	1,693	NA.
Other:			
Ore and concentrate:			
Titanium-vanadium	11,896	851	Australia 828.
Base metals, n.e.s	2,511	2,196	Australia 1,819.
Ash and residue containing nonferrous metals	912	3,574	Australia 1,685.
Base metals, n.e.s	380	386	Taiwan 134; United Kingdom 63.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	2,837	4,731	NA.
Grinding and polishing wheels and stones	228	264	United Kingdom 88; West Germany 72.
Asbestos	13,994	13,127	NA.
Barite	2,564	3,573	West Germany 834; United Kingdom 678.
Boron materials, crude natural borates	347	651	United States 612.
Cement	35,524	41,886	United Kingdom 6,883; Japan 4,208.
Chalk	3,535	3,754	France 2,450; United Kingdom 849.
Clays and clay products:			
Crude clays and refractory minerals	9,080	12,298	United Kingdom 5,809; United States 5,588.
Products:			
Refractory	15,548	13,165	Austria 4,744; West Germany 2,552; United Kingdom 2,061.
Nonrefractory	6,427	9,885	Japan 3,521.
Cryolite and chiolite	112	60	NA.
Diamond:			
Gem—carats	3,282	91,753	United Kingdom 77,514.
Industrial—thousand carats	19,139	3,618	United Kingdom 1,226; Ireland 411.
Diatomite	3,587	3,884	United States 3,257.
Feldspar	203	163	NA.
Fertilizer materials:			
Crude:			
Nitrogenous	960	1,453	Chile 1,020; West Germany 399.
Phosphatic	87,570	77,176	NA.
Potassic	116,707	137,462	West Germany 44,342; Spain 42,146.
Manufactured:			
Nitrogenous	75,969	8,548	West Germany 5,295.
Phosphatic:			
Thomas (basic) slag	17,835	16,007	Belgium 15,895.
Other	79,101	1,100	West Germany 907.
Potassic	53,200	34,347	West Germany 19,248; Israel 5,604.
Other, including mixed	35	7,632	West Germany 4,445; France 2,701.
Graphite, natural	472	492	United States 280; Norway 138.
Gypsum and plaster	4,777	5,447	West Germany 3,838; United Kingdom 1,514.
Lime	262	205	NA.
Magnesite	55,133	79,247	NA.
Mica:			
Crude, including splittings and waste	191	147	NA.
Worked, including agglomerated splittings—value, thousands	$641	$486	United Kingdom $366.
Pigments, mineral:			
Natural, crude	661	635	United Kingdom 313; Austria 280.
Iron oxides, processed	2,172	2,668	West Germany 1,690; United Kingdom 652.
Precious and semiprecious gem stones, except diamond—value, thousands	$2,321	$842	NA.
Pyrite	7,797	8,576	Spain 8,563.
Salt (excluding brines)	2,138	1,982	United Kingdom 1,647.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	14,749	10,514	Netherlands 4,887; United Kingdom 2,062.
Caustic potash	514	633	France 222; Belgium 139.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	1,148	982	Italy 923.
Other	66	8	NA.

See footnotes at end of table.

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Table 3.—Republic of South Africa: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS—Continued			
Stone, sand and gravel:—Continued			
Worked	254	498	Italy 333; Portugal 100.
Gravel and crushed stone	4,511	70,794	NA.
Limestone and dolomite (except dimension)	97	1,483	Sweden 1,073.
Quartz and quartzite	20	14	NA.
Sand, excluding metal bearing	306	243	United States 115.
Sulfur:			
Elemental:			
Other than colloidal	200,130	222,007	Canada 95,920; Poland 58,321; United States 47,784.
Colloidal	299	399	United States 219; West Germany 170.
Sulfur dioxide	30	19	NA.
Sulfuric acid	2,271	6,440	NA.
Talc and steatite	1,689	2,100	Italy 740; South Korea 477; Norway 388.
Other nonmetals, n.e.s.:			
Crude	687	595	United Kingdom 124; United States 86.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	21,113	30,156	All from Canada.
Slag and ash, n.e.s	22	67	NA.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	1,711	2,104	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	8,336	8,824	United States 6,250.
Carbon and carbon black	5,064	5,886	United States 3,872; United Kingdom 546.
Coal, all grades, including briquets	753	20,993	NA.
Coke and semicoke	3,810	6,210	NA.
Gas, hydrocarbon, natural	112	352	NA.
Peat	30	52	NA.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	73,335	54,693	NA.
Refinery products:			
Gasoline ---do---	3,412	5,815	NA.
Kerosine and jet fuel ---do---	3,371	3,434	NA.
Distillate fuel oil ---do---	3,196	3,312	NA.
Residual fuel oil ---do---	4,243	6,935	NA.
Lubricants ---do---	1,472	1,182	United States 396; United Kingdom 328.
Jelly and wax ---do---	216	189	United States 108; Japan 37.
Other:			
Nonlubricating oils, n.e.s. ---do---	420	3,109	NA.
Pitch	994	697	United Kingdom 638.
Pitch coke	51	25	NA.
Petroleum coke	11,392	5,383	All from United States.
Bitumen and other residues	5,347	3,844	United States 2,450; Netherlands 834.
Bituminous mixtures, n.e.s.	531	402	United Kingdom 224; United States 85.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemcals	34	335	All from United Kingdom.

NA Not available.

[1] Source: Foreign Trade Statistics. Volume I, 1968, compiled by the Department of Customs and Excise, and includes Botswana, Lesotho, Swaziland, and the Territory of South-West Africa.

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Table 4.—Republic of South Africa: Major domestic mineral sales in 1969 [1]

Commodity	Thousand dollars
METALS	
Chromite	$2,103
Copper	45,193
Iron ore	17,249
Manganese ore	7,836
Tin	2,439
NONMETALS	
Andalusite and sillimanite	378
Asbestos	3,004
Clays	2,385
Feldspar	686
Fluorspar	459
Gypsum	1,310
Limestone	11,669
Lime products, burnt	9,549
Magnesite	807
Phosphate rock	13,009
Pyrite (for sulfur)	6,456
Salt	3,545
Silica	2,130
Slate	1,110
Stone, dimension	14,443
MINERAL FUELS AND RELATED MATERIALS	
Coal	137,894
MISCELLANEOUS	
Other minerals	49,563
Total	333,217

[1] Does not include gold, silver, and diamond, data on which are not available.

Source: Republic of South Africa, Department of Mines. Quarterly Information Circular. October–December 1969, pp. 28, 29.

Table 5.—Republic of South Africa: Major mineral exports in 1969

Commodity	Thousand dollars
METALS	
Antimony, concentrates	$10,631
Chromite	11,466
Copper	116,457
Gold [1]	1,160,777
Iron ore	21,405
Manganese ore	29,764
Silver [1]	6,149
Tin, concentrate	3,571
Vanadium:	
Pentoxide and ammonium vanadate	8,633
Slag	5,896
NONMETALS	
Andalusite and sillimanite	2,542
Asbestos	40,323
Clays	3,998
Diamond [1]	145,487
Feldspar	736
Fluorspar	3,287
Gem stones, semiprecious	791
Lime and limestone	559
Mica	599
Salt	329
Stone, dimension	6,803
Vermiculite	2,607
Wonderstone (pyrophyllite)	492
MINERAL FUELS AND RELATED MATERIALS	
Coal	10,621
MISCELLANEOUS	
Other minerals	154,374
Total	1,748,292

[1] Total value, including domestic sales, if any.

Source: Republic of South Africa, Department of Mines. Quarterly Information Circular. October–December 1969, pp. 30, 31.

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COMMODITY REVIEW

METALS

Aluminum.—Construction continued on the 50,000-ton-per-year aluminum smelter, South Africa's first, at Richards Bay, Natal coast. The production company will be Alusaf (Pty.) Ltd., formed by the Government-owned Industrial Development Corp. and participated in by Alcan Aluminium of South Africa Ltd. Plant completion is scheduled for 1971. Alumina will be imported from Australia under a 20-year, $280 million contract with Suisse Aluminium Industrie A.G., probably starting in 1973. Present Alcan sources will supply alumina during the period before the Australian source is in production.

Alcan, the largest producer of aluminum products in South Africa, purchased the entire share capital of Republic Aluminium Co. (Pty.) Ltd. for a reported $1.96 million. Alcan installed a $1.8 million extrusion press at the Pietermaritzburg plant, the fourth and largest there, and a $1.2 million extrusion press at Epping, Cape Town.

Union Steel Corp. of South Africa planned a continuous casting and manufacturing installation at Richards Bay, near the aluminum smelter. Aluminum rod will be cast and processed to stranded conductors.

Antimony.—According to its 1969 annual report, Consolidated Murchison (Transvaal) Goldfields and Development Co. Ltd., the largest single producer of antimony in the non-Communist world, produced 28,423 tons of concentrate at 61.42 percent antimony and 1,192 tons of cobbed ore at 58.67 percent, during 1969. A total of 300,200 tons of ore was milled, compared with 226,500 tons in 1968. Expansion to the reduction plant was completed in July. The company planned to roughly double mill capacity to 500,000 tons per year by 1980. Surface exploratory drilling and geochemical prospecting continued in conjunction with mine development.

Chrome and Chromite.—Accelerated world steelmaking activities during 1969 increased the already strong international demand for South African chrome ores. Ore shipments to domestic markets and to ports were hindered by a shortage of rail facilities. As a result, several mining companies delayed contract negotiations and postponed mine expansions until South African Railways was able to provide sufficient rail cars. Chromite prices ranged from $10 to $14 per ton f.o.b. Lourenço Marques, Mozambique, during the year. At yearend, South African producers had advance orders for the entire anticipated 1970 output.

The largest chrome producer in South Africa during 1969 was Rand Mines Ltd., which controls approximately half of total South African chromite reserves of 2.6 billion tons. Although most of the company's ore was exported, substantial tonnages went into ferrochrome production.

Copper.—Total sales of copper, including both export and domestic sales, were valued at $161.7 million in 1969. Copper ranked second, after gold, in mineral sales value. The growth rate in income from copper has averaged 35 percent annually since 1965.

In 1969, Palabora Mining Co. Ltd., largest producer in the country, produced 15,700,128 tons of ore at 0.60 percent copper; 272,801 tons of concentrate at 32.2 percent copper; and 78,540 tons of electrolytic copper at its mine and refinery at Phalaborwa. These figures represent increases over 1968 in all categories, except that grade of ore mined was slightly reduced. Palabora announced construction of a sixth unit to the concentrator, permitting treatment of lower grade ore and addition of fifty large flotation cells (300-cubic-foot capacity) as part of its expansion program.[7]

O'okiep Copper Co. Ltd. produced 33,928 tons of blister copper (37,595 tons in 1968) from 2,837,200 tons of ore containing 1.34 percent copper. The company has nine copper mines and three mills in operation. Discovery of two new ore bodies, one of which reportedly comprises more than 2 million tons at 1 to 2 percent copper, substantially improved the company's ore reserve position.[8] A 3-year drought in the region threatened O'okiep's future operations. At yearend, the company considered constructing an 80-kilometer pipeline to the Orange River to replace the existing 50-kilometer line to the

[7] South African Mining and Engineering Journal. V. 80, No. 3994, Aug. 22, 1969, p. 417.
[8] Metal Bulletin. No. 5436, Sept. 30, 1969, p. 14.

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Buffels River where the water level was extremely low.

Operations at the Messina mine and refinery of Messina (Transvaal) Development Co. Ltd. (fiscal year ending September 30) were at a rate similar to 1968. The company produced 1,044,000 tons of ore at 1.11 percent copper and 11,880 tons of fire-refined copper (12,302 tons in 1968). Sinking at the Spencer shaft was completed to 50 feet below the 1,500-foot level.

An old copper mine at Mutali, northeast Transvaal, has been reopened by the African Copper Corp. Reported ore reserves are 25 million tons at about 1 percent copper.[9] Mining is by open pit methods. Underground development is underway. The company planned ore output of 1,500 tons per month.[10]

A new deposit near Prieska in northern Cape Province, containing 1.5 to 2 percent copper and also recoverable zinc and pyrite, was under development by the Anglovaal group. United States Steel purchased a 15-percent interest in this project. Diamond drilling and shaft sinking to a depth of 210 meters was in progress at yearend. Reported ore reserves were 35 million tons containing 1.75 percent copper. The company planned to obtain a bulk sample for metallurgical testing.

Matte Smelters (Pty.), a subsidiary of RPM, produced an estimated 1,200 tons of electrolytic copper as a byproduct of platinum mining. Impala Platinum Mines Ltd., associated with Union Corp. Ltd., also has a small electrolytic plant at East Geduld for making large copper anodes and cathodes as a byproduct of platinum operations. Copper is recovered from leach solutions containing copper and nickel sulfates.[11]

Transvaal Copper Rod Co., Ltd., a joint venture of Union Steel Corp. and Palabora Mining Co. Ltd., began production at a $3.5 million continuous casting plant.

Gold.—During 1969 another record was attained in production of newly mined gold. The total output of 31,275,882 ounces includes 30,891,758 ounces from normal gold-uranium operations and 384,124 ounces from miscellaneous other sources, according to statistics released by the Chamber of Mines of South Africa. Gold accounted for nearly two-thirds of the total value of mineral sales. The Orange Free State continued as the leading producing district with 11.2 million ounces and was followed by the Far West Rand, 8.8 million ounces; Klerksdorp, 4.9 million ounces; the Central, East, and West Rand, 4.0 million ounces; and Evander, 2.0 million ounces.

Operations continued to slowly expand despite a growing shortage of both skilled and unskilled workers and increasing costs. Average working cost per ton of ore milled was $8.81 in 1968 and $8.97 in 1969. This increase was due mainly to higher costs for labor and supplies. Also, abnormally high costs at the West Driefontein mine, South Africa's leading producer, following the major flooding of October 1968, added to average working costs. By mid-1969, operations at West Driefontein were restored to 85 percent of the preflooding mining rate.

During 1969, five new mines were in advanced development or had reached initial production. No mines were closed during the year, although seven of the 48 operating mines incurred working losses. The Gold Mines Assistance Act of 1968 permitted 19 marginal mines to continue production at a cost of $12 million. Output from these assisted mines represented more than 10 percent of total foreign exchange earnings of the gold-mining industry. Assisted mines employed 8,000 white miners and 85,000 African laborers. The possible extension of this program to include other marginal producers of vital metals and fuels will be a factor in future planning.

The Kloof mine of Gold Fields of South Africa Ltd. completed its first full year of operations on June 30, 1969. The Gold Fields East Driefontein mine, potentially the richest mine to open in the last 10 years, was on schedule in shaft sinking and underground development. Hoisting of first ore was scheduled for 1973. The Kinross mine of Union Corp. Ltd. was in its second year of operations. The Johannesburg Consolidated Investment Co. Ltd. Elsburg mine was in the final stage of development. Anglo American Corp. of South Africa Ltd. announced that production at its Vaal Reefs South property was scheduled for late 1971.

Throughout the year, South Africa was affected by the problem of marketing its

[9] Mining and Minerals Engineering. V. 5, No. 4, April 1969, p. 52.
[10] Engineering and Mining Journal. V. 170, No. 3, March 1969, p. 187.
[11] South African Mining and Engineering Journal. V. 80, No. 3989, July 18, 1969, p. 157.

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Table 6.—Republic of South Africa: Gold output, by major producers, 1969
(Troy ounces)

Company or mine	Production
Blyvooruitzicht	1,090,775
Bracken	460,983
Buffelsfontein	1,223,459
City Deep	186,700
Crown Mines	160,942
Doornfontein	749,600
Durban Deep	398,840
East Daggafontein	291,668
East Geduld	239,764
East Rand	687,443
Elsburg	188,254
Freddies Consolidated	475,473
Free State Geduld	1,954,542
Free State Saaiplaas	678,449
Grootvlei	406,296
Harmony	1,024,099
Hartebeestfontein	787,619
Kinross	514,408
Kloof	710,543
Leslie	508,095
Libanon	623,238
Loraine	404,075
Luipaards Vlei	123,302
Marievale	297,164
President Brand	1,614,826
President Steyn	930,968
St. Helena	1,096,032
South Africa Lands	338,735
Stilfontein	669,561
Sub Nigel	139,205
Vaal Reefs	1,123,288
Venderspost	532,017
Virginia	408,088
Vlakfontein	290,983
Welkom	779,145
West Driefontein	2,102,098
Western Areas	711,537
Western Deep Levels	2,049,170
Western Holdings	1,809,890
Western Reefs	749,074
Winkelhaak	559,938
Zand Pan	378,420
Miscellaneous	807,176
Total	31,275,882

Source: Chamber of Mines of South Africa. January–December, 1969.

newly mined gold. Because the International Monetary Fund (IMF) did not purchase South African gold at $35 per ounce, the South African Central Bank withheld sales, sold on a number of occasions to European central banks, and sold limited quantities in the private market. Special sales totaled $80.1 million during 1969. Because of these free market sales, the average price received was $37.17 per ounce.

Late in the year, the IMF and South Africa concluded an agreement on South African sales of newly mined gold. Most will be sold in the free market, but South Africa may sell to the IMF at $35 per ounce when the free market price falls to $35 but only to the extent of its foreign exchange needs (on a day-to-day basis) or from reserves when newly mined gold fails to cover foreign exchange needs in each successive 6-month period.[12]

Iron, Steel, and Ferroalloys.—*Iron Ore.*—Total ore production of 8,788,000 tons in 1969 included 6,906,000 tons of hematite and 1,882,000 tons of magnetite. ISCOR produced 4.2 million tons at its Sishen and Thabazimbi mines in fiscal 1969 (ending June 30). Expansion plans call for annual capacity of 8.2 million tons at Sishen by 1980 and 2 million tons at Thabazimbi by 1973.

Ore reserves at the Kraaipan deposit, northern Cape Province, orginally estimated at 800 to 900 million tons, have been revised downward to 400 million tons

[12] Metals Week. V. 41, No. 2, Jan. 12, 1970, pp. 17–18.

Table 7.—Republic of South Africa: Salient statistics of gold and uranium production by members of the Chamber of Mines, Transvaal and Orange Free State

		1968	1969
Number of operating mines		r 46	48
Ore milled	thousand short tons	78,795	80,690
Production of gold:			
Gross weight	thousand troy ounces	30,759	30,892
Per ton of ore milled	troy ounce	r 0.389	0.383
Number of uranium-producing mines		8	8
Ore treated for uranium recovery	thousand short tons	13,656	14,260
Production of uranium oxide (U_3O_8):			
Gross weight	thousand pounds	7,766	7,958
Per ton of ore milled	pound	0.57	0.56
Average realized gold price per ounce		r $35.34	$37.17
Working profit, gold and uranium	thousands	$436,962	$483,317
Taxes and lease fees payable to Government	do	$160,693	$182,062
Net dividends	do	$158,816	$180,334
Average number of employees in service:			
Whites		40,491	39,660
Nonwhites		368,135	364,151
Mine development, including shaft sinking	thousand feet	2,941	3,067
Ore reserves, payable	thousand short tons	159,060	152,882
Average grade of reserves	troy ounce per ton	0.467	0.476

r Revised.

Source: Chamber of Mines of South Africa. Published in Reports and Accounts, 1969. Union Corp. Ltd.

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as the result of more detailed study. The role of this ore is supplying the export market, as originally planned, was questionable yearend.

Early in the year, ISCOR concluded an agreement with three Japanese trading houses for delivery of 1.2 million tons of ore over a 3-year period starting in February.[13] ISCOR also offered up to 3 million tons per year for 15 years, shipped from a loading station offshore from Port Elizabeth, capable of handling 200,000-dwt carriers.[14] Representatives of Japanese companies visited South Africa in September and October to confer with ISCOR officials. Late in the year, ISCOR reportedly received a letter of interest for long-term supply to Japan. Firm negotiations were expected in 1970.[15] High railage and loading costs (approximately $6.25 per ton) tended to offset moderate mining costs ($2 per ton). Total cost landed in Japan was estimated at $13 per ton. Apparently, ISCOR must lower its ore price by reduced rail rates and increased ore haulage capacity by rail to Port Elizabeth, where modern offshore bulk loading facilities for large ore carriers were planned. ISCOR and South African Railways (SAR) submitted a technical report to the Government on a proposed $250 million project for shipping and loading 15 million tons of ore per year.

The Mapochs mine of Highveld Steel and Vanadium Corp. Ltd., controlled by Anglo American Corp., produced 643,427 tons of magnetite concentrate in 1969. In July, after 18 months, the mine reached 75 percent of designed capacity of 900,000 tons annually and at yearend was operating at full capacity.

According to its annual report, Palabora Mining Co. Ltd. reported magnetite sales of 873,414 tons in 1969, a slight improvement over the previous year.

Iron and Steel.—ISCOR produced 2.9 million tons of pig iron and 3.35 million tons of ingot steel in fiscal 1969. ISCOR also produced 77 percent of total mill products in 1969. The Vanderbijlpark steelworks produced 1,992,000 tons of ingot, and the Pretoria plant produced 1,359,000 tons. According to its annual report for fiscal 1969, ISCOR gross sales were $314.5 million, including coke-oven byproducts. The company provided 77.2 percent of the South African iron and steel supply during the year; 17.8 percent was supplied by other domestic producers, and 5 percent was imported.

Expansion and modernization continued at both plants. ISCOR announced plans for a $1,260 million program during 1970–80, including a new steelworks at Newcastle, Natal Province, increasing ingot capacity by 1980 to 7.3 million tons (Vanderbijlpark 3.7 million tons, Newcastle 2.1 million tons, and Pretoria 1.5 million tons).[16] Pretoria expansion includes mainly universal, rail, and small section and rod mills. New facilities at Vanderbijlpark include a slab mill, a hot-strip mill for strip 72 inches wide, a third galvanizing line (increasing galvanized sheet capacity to 350,000 tons yearly), a fourth blast furnace, and two electric arc furnaces (each with a 150-ton charge and 3-hour melt).

In May the Minister of Economic Affairs announced plans for the new ISCOR steelworks at Newcastle. Initial capacity will be 400,000 tons. Production was scheduled for 1973.

The new Highveld Steel and Vanadium Corp. plant at Witbank was officially opened early in the year. Full production of the iron and steel plants was attained in October.

Union Steel Corp., the largest producer of special steels, announced a $17 million expansion and modernization program, including new electric arc furnaces, rolling facilities, and continuous casting equipment.

Ferroalloys.—Anglo Transvaal Consolidated Investment Co. Ltd. and United States Steel Corp. planned a $14 million ferrochrome plant at Fairview, eastern Transvaal, with production expected in 1971.

RMB Alloys Ltd. and Southern Cross Steel Co. Ltd., members of the Rand Mines Ltd. group, were joined with Palmiet Chrome Corp. (Pty.) Ltd., a member of the General Mining and Finance Corp. Ltd., in a new company—Middleburg Steel and Alloys Ltd. This company produced about 63,000 tons of converted metal in 1969, nearly 20 percent of total world out-

[13] Mining and Minerals Engineering. V. 5, No. 3, March 1969, p. 65.
[14] Metal Bulletin. No. 5405, June 10, 1969, p. 32.
[15] Mining Journal. V. 274, No. 7011, Jan. 2, 1970, p. 10.
[16] South African Mining and Engineering Journal. V. 80, No. 4008, Nov. 28, 1969, pp. 1,202, and 1,225.

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put of ferrochrome for steelmaking. Construction of new furnaces and ancillary facilities was in progress at all three plants. Planned output for 1970 was 76,000 tons of low-carbon ferrochrome and 13,000 tons of high-carbon ferrochrome. Planned combined annual capacity, probably by mid-1971, is 100,000 tons. New facilities will enable production of thin-gauge stainless steel, probably in 1970.[17]

Manganese.—The principal producers were South African Manganese Ltd. and Associated Manganese Mines of South Africa Ltd. These two companies accounted for a total of 2 million tons of ore during 1969. Declining ore (and ferromanganese) prices had an adverse effect on financial results of both companies, although output was increased and operating costs were reduced.

Improved loading facilities at Port Elizabeth and a $0.28-per-ton reduction in ore-handling charges were favorable factors. South African representatives were not invited to a proposed conference of manganese-producing countries in India.

Nickel.—South Africa's two major platinum mines—Rustenburg and Impala—produced an estimated 10,000 tons of byproduct nickel in 1969. Impala expects to recover 8 million pounds per year by 1972.

Platinum.—Production continued to increase as mining companies were undergoing expansion, and several companies started exploration for platinum. The annual production rate was 1.1 million ounces at yearend and was expected to reach 1.5 million ounces in 1972. Interest of the United States Government and industry in the role of platinum in problems of air pollution by internal combustion engines provided an incentive to South African producers and investors.

RPM, the leader in the industry, essentially completed its second expansion program (to 1 million ounces per year) in 1969 and embarked on a third, a $42 million plan to increase output to 1.2 million ounces by 1973. According to the annual statement of the chairman, RPM production was about 900,000 ounces in 1969. A 1-million-ounce annual rate was achieved in September. Current mine expansion includes two new deep shafts, bringing the total to six, and new electric hoisting equipment on the four existing shafts. Two mines produce ore for a high-grade gravity concentrate, which goes to the United Kingdom for refining, and a converter matte (from flotation concentrate), part of which goes to the United Kingdom, and part is refined at the new $15 million refinery at Wadeville in the Germiston industrial district. This refinery, an extension to an existing refinery, went on stream in October and is jointly owned by Johnson, Matthey and Co. Ltd. and RPM. The converter matte is produced by Matte Smelters (Pty.) Ltd., another Johnson, Matthey-RPM joint venture. The matte contains 46 percent nickel, 28 percent copper, and 50 ounces of platinum per ton.

Imapla Platinum Mines Ltd., formed by Union Corp. Ltd., officially opened its Bafokeng mine and nickel-copper and platinum refineries at East Geduld, near Springs, 50 kilometers east of Johannesburg, in July. The capital cost of the project was $55 million. Refinery production started in November at an annual rate of 100,000 ounces. Anticipated future rates are 180,000 ounces in 1971 and 300,000 ounces in 1972. Platinum is marketed through Ayrton Metals Ltd., which is controlled by Impala. The Bafokeng mine is serviced by four pairs of inclined shafts and one vertical shaft. A second vertical shaft is planned. International Nickel Co. of Canada Ltd. provided assistance in platinum refinery design; Sherritt Gordon Mines Ltd., Canada, was consulting engineer for the nickel-copper refinery; Fraser and Chalmers South Africa (Pty.) Ltd. performed design and construction work on the gravity concentrator and flotation plant; Lurgi Gesellshaft für Chemie und Hüttenwesen m.b.H. provided technical assistance in smelter production; and Davy-Ashmore South Africa (Pty.) Ltd. assisted in design and construction of the nickel-copper refinery.[18]

Atok Investments (Pty.) Ltd., comprising Anglovaal (two-thirds) and Middle Witwatersrand (one-third), started small-scale mine development at its deposit in Sekhukhuneland, 60 kilometers southeast of Pietersburg in the Lydenburg district. Initial output will be at a rate of 15,000 ounces per year. A $2.8 million concentrator for platinum-group metals, nickel, copper, and gold was completed. Flotation concentrate

[17] South African Mining and Engineering Journal. V. 80, No. 3992, Aug. 8, 1969, p. 321.
[18] South African Mining and Engineering Journal. V. 80, No. 4007, Nov. 21, 1969, pp. 1167–1171.

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will be smelted to matte by Middle Witwatersrand, and this matte and a gravity concentrate will be shipped to overseas refineries.[19]

Lontho Ltd. conducted underground exploration and completed four deep drill holes, all reportedly mineralized, in the Merensky Reef near Rustenburg. The company hopes to start production at a rate of 50,000 ounces annually in 1971. Two inclined shafts were being sunk for development to 520 meters.

Exploration for platinum was underway by Transvaal Platinum Consortium (Pty.) Ltd., comprising Klöckner Ferromatic South Africa Ltd. and three associates, in the Grobersdal area; by a South African subsidary of Falconbridge Nickel Mines Ltd., Canada, on the Buffelshoek farm; and by African Metals Corp. in the Thabazimbi area.

Tin.—Rooiberg Minerals Development Co. Ltd. continued a 1.8 million expansion at Warmbaths, where production will be increased from the current rate of 1,140 to 1,380 long tons of tin-in-concentrate by mid-1970. According to the company's annual report (fiscal year ending June 30, 1969), trial milling started at the new plant, and heavy-media separation was planned for early 1970.[20]

Union Tin Mines Ltd. produced 630 long tons of tin-in-concentrates during the fiscal year (ending June 30). The company attempted to improve efficiency of tin recovery by flotation of tailings stockpile and gravity plant tailings.

Uranium.—Production was gradually expanding, despite the slow growth of world demand for nuclear fuels in power generation. Output of uranium oxide by eight gold-mining companies was 7,957,765 pounds in 1969. Members of the General Mining and Finance Corp. Ltd. group accounted for nearly 37 percent of total output, and the Anglo American Corp. group produced about one-third of the total. Substantial quantities of uranium oxide were being stockpiled because demand was slack during the year. Nuclear Fuels Corp. Of South Africa (Pty.) Ltd. (NUFCOR) negotiated an agreement with Sumitomo Shoji Kaisha Ltd., Japan, for delivery of 450 tons of uranium oxide in the near future.

Because of a projected increase in demand for nuclear fuels starting in the mid-1970's, several gold-mining companies formerly producing uranium were preparing to resume uranium recovery. Two new processing plants for uranium were completed, and two were under construction. Three gold-mining companies of the Anglo American group—President Brand, Free State Saaiplaas, and Welkom—started a $28 million joint operation. The President Brand mine will build the treatment plant for uranium-bearing slimes from the three gold mines. Capacity will be 180,000 tons per month.[21] Western Deep Levels Ltd., another Anglo American group property, completed a new, automated solvent extraction plant for uranium late in the year. Capacity is 70,000 tons per month. The plant will treat the fine fraction from gold ores.[22]

Vanadium.—The official opening of the Highveld Steel and Vanadium Corp. complex at Witbank, eastern Transvaal, took place in April 1969. All units were in production. When rated capacity is reached in 1971, output will be 430,000 tons of vana-

[19] Mining Journal. V. 272, No. 6982, June 13, 1969, p. 532.
[20] Tin International. V. 42, October 1969, p. 625.
[21] Coal, Gold and Base Minerals. V. 17, No. 8, October 1969, p. 28.
[22] Mining Magazine. V. 122, No. 2, February 1970, p. 91.

Table 8.—Republic of South Africa: Uranium production, by company, 1969

Gold-uranium producer	Gold ore treated (thousand short tons)	Production U_3O_8 (pounds)	Grade (pounds per ton)
Buffelsfontein	3,086	1,594,893	0.517
Harmony	2,090	657,889	.315
Hartebeestfontein	2,142	793,076	.370
Vaal Reefs	2,054	1,235,363	.601
Virginia	1,250	689,983	.552
Western Reefs	1,928	1,150,519	.597
West Rand Consolidated	919	1,322,426	1.438
Zandpan	792	513,616	.649
Totals and average	14,261	7,957,765	.558

Source: Chamber of Mines of South Africa. January-December, 1969.

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dium-bearing hot metal, from which 23 million pounds of vanadium pentoxide (V_2O_5) in slag will be recovered by oxygen blowing at the Vantra Division. Late in the year, production was at a rate of 27,000 tons of hot metal per month, 75 percent of rated capacity. V_2O_5 sales increased nearly 80 percent (fiscal year ending June 30, 1969). Production was expanded by restarting two kilns, which were shut down during the weak market in 1968. Exports of vanadiferous slag totaled 20,925 tons, valued at $5.9 million, in 1969.

Ucar Minerals Corp., wholly owned subsidiary of Union Carbide Corp., planned to convert the Brits V_2O_5 plant to production of vanadium carbide. Also, a $2.8 million expansion to the Bon Accord plant, north of Pretoria, was planned for making "Carvan," a vanadium additive to alloy steels.

Zinc.—The Republic's first electrolytic slab zinc was cast in April at the refinery of Zinc Corp. of South Africa Ltd., near Springs, Transvaal. Annual capacity is 100 tons per day of high-grade zinc. Raw materials sources are two mines in South-West Africa. Because of this new production, imports of zinc, mainly for galvanizing and production of brass, dropped from $11 million in 1968 to $1.4 million in 1969.

The new copper-zinc-pyrite mine of Africa Triangle Mining, Prospecting, and Development Co. (Pty.) Ltd., near Prieska, northern Cape Province, contains about 3 percent recoverable zinc.

NONMETALS

Asbestos.—Low production costs, resulting in a competitive product in world markets, was the key feature in the steadily expanding asbestos mining during 1969. Charter Consolidated Ltd., a London affiliate of the Anglo American Corp., acquired Cape Asbestos Ltd., South Africa's largest asbestos mining company, which operated the large amosite mine at Penge, northeastern Transvaal, and crocidolite mines in northwestern Cape Province. The company exports about 130,000 tons of asbestos fiber annually.

Other important producers during the year were the Msauli chrysotile mine and the Gefco crocidolite mine of General Mining and Finance Corp. and the South African Trading Co.'s crocidolite mines at Kuruman, Cape Province. Expansion was underway at Msauli. At the Gefco mine, plans were made to exploit new reserves and raise milling capacity.

Cement.—A high level of production was maintained, and demand continued high, in 1969. At times, demand exceeded supply, creating temporary shortages. Expansion programs were underway by most companies. Since 1966, total capacity has increased 44 percent, representing an investment of $32 million.

Four major cement manufacturers planned a $60 million investment in new facilities through 1971. Anglo-Alpha Cement Ltd. will install a second kiln at its Dudfield complex and a fourth kiln at Ulco at a cost of $23 million. White's South African Portland Cement Co. Ltd. will increase capacity by 50 percent (to 1.4 million tons per year) at Lichtenburg with a new cooler, grinding plant, two packing plants, and new loading facilities at a cost of $20 million. Pretoria Portland Cement Co. Ltd. will spend $13 million in increased clinker capacity and other short-term projects. Durban Cement Co. Ltd. will triple output at its Bellair works at a cost of $3.5 million.[23]

Chemical industries of South Africa (Pty.) Ltd., a member of the Federale group, planned a clinker plant at Phalaborwa in conjunction with its sulfuric acid project there.

Clays.—*Bentonite.*—G. and W. Base and Industrial Minerals Co. Ltd., associated with Anglo American Corp., reported a discovery near Plettenberg Bay, Cape Province. The principal producer is Ocean Bentonite (Pty.) Ltd. in the Parys district, Orange Free State. Annual consumption is 20,000 to 24,000 tons, much of which has been imported in the past.[24]

Diamond.—According to the annual report of De Beers Consolidated Mines Ltd. for 1969, sales to the Central Selling Organization totaled $692.1 million in 1969, a 15-percent increase over 1968.

Expansion in the alluvial deposits of Namaqualand continued with new reserves and a marked increase in output, especially at the Annex Kleinzee. Work on reopening the Koffiefontein mine in the Orange Free State, closed since 1931, was on schedule with production planned in 1970.

[23] Cement, Lime and Gravel. V. 45, No. 3, March 1970, p. 72.
[24] Industrial Minerals. No. 23, August 1969, p. 34.

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The mine is being dewatered to the old pit floor, 110 meters below the surface. The Jaggersfontein mine, nearly mined out, will close in the near future, after 100 years of operation. The Finsch mine, second-ranking producer after the Premier mine, is going underground. A 16-foot shaft is being sunk in initial depth of 380 meters.

A new instrument using X-ray for recovering diamonds of 0.3 carats or larger was tested at the Finsch mine. The method involves an X-ray beam trained on gravel passing on a special sorting table and a compressed air jet for diamond recovery from the gravel. The principle was developed by the Diamond Research Laboratory.[25]

In April, Boart and Hard Metals Ltd. announced the building of a revolutionary press for the manufacture of synthetic stones at its High Pressure Materials Laboratory in Johannesburg. The press consists of six rams which, when activated, converge on a single point and operate at a load up to 2,000 tons. Forgings for the frame of the press were manufactured in West Germany. All machining was done in South Africa. According to scientists at the laboratory, the advantage of the multiram machine is that the pressure on the synthesis components is equal in all directions.

An old-style diamond rush occurred at Fonteintjie, near Barkly West, northern Cape Province, on July 7 when 243 diggers, all in possession of valid digger certificates, pegged claims in newly proclaimed diggings. The rush was inspired by discovery of a stone that sold for $56,000.

Table 9.—Republic of South Africa: Diamond production of De Beers Consolidated Mines, Ltd.

(Carats)

Mine	1968	1969
Bultfontein	259,471	262,591
De Beers	222,337	236,683
Dutoitspan	189,705	189,555
Finsch	2,215,955	2,236,422
Jagersfontein	106,578	98,806
Kimberley dumps	186,053	209,763
Namaqualand areas (Annex Kleinzee, Dreyer's Pan, Langhoogte)	493,908	702,122
Premier	2,431,618	2,522,162
Wesselton	518,635	529,635
Miscellaneous	1,966	1,606
Total	6,626,226	6,989,345

Source: De Beers Consolidated Mines Ltd. Annual Report, 1969.

Fertilizer and Chemical Materials.—Throughout the year, production capacities for fertilizers and chemicals were near the limits, and new facilities were needed to meet consumer demand and increased export sales of the near future. Most companies had expansion programs underway.

Late in the year, Albatros Superphosfaatfabrieken N.V., Federale Volksbeleggings Beperk, and the Industrial Development Corp. announced plans for a new joint holding company to acquire interests in four South African companies—Fisons (Pty.) Ltd., Bosveld Kunsmis Beperk, Chemical Industries of South Africa Ltd., and Optichem Fertilizers Ltd.[26]

African Explosives & Chemical Industries Ltd. (AE & CI), the largest chemical company in the Republic, reportedly acquired the holdings of the Kimfos group, which comprises the Saldanha Bay Aluminium Co. (aluminum phosphate producer), the Kimberley Phosphate Co. (calcium phosphate producer), and the Pretoria North Development Co. (aluminum phosphate producer.[27] AE & CI's 165,000-ton-per-year sulfuric acid plant at Modderfontein, near Johannesburg, completed its first full year of operation and made plans to double capacity by 1970. A $3 million phosphoric acid plant (annual capacity 30,000 tons) was under construction at Somerset West, Cape Province, with production scheduled for 1970. This plant will use phosphate rock from Phalaborwa.[28] AE & CI also was attempting to establish foreign export markets for nitrogenous fertilizer materials from its Umbogintwini factory.

Chemical Industries of South Africa (Pty.) Ltd., a member of the Federale group, planned a sulfuric acid plant (eventual annual capacity 300,000 tons) at Phalaborwa, based on byproduct phosphogypsum produced at an adjacent phosphoric acid plant. This plant will produce the world's first sulfuric acid from gypsum, which will be processed to give sulfur dioxide gas and lime from which sulfuric acid and cement clinker will be manufactured. The construction contract for the sulfuric acid plant was awarded to F.

[25] Science News. V. 95, No. 25, June 21, 1969, p. 600.
[26] Phosphorus and Potassium. No. 44, November–December 1969, pp. 51–52.
[27] Industrial Minerals. No. 26, November 1969, p. 35.
[28] Phosphorus and Potassium. No. 41, May–June 1969, p. 7.

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Krupp G.m.b.H. for construction in two stages.[29]

The Government-owned Phosphate Development Corp. Ltd. (FOSKOR) reduced its phosphate price from $15.04 to $12.87 per short ton in January as a result of higher productivity, greater general efficiency, and lower operating costs. A $4.9 million expansion in concentrate handling and drying was underway. FOSKOR profitably worked the low-grade pyroxenite deposits at Phalaborwa after earlier beneficiating difficulties.[30] During the operational year (excluding June 25, 1969) FOSKOR mined 9.2 million tons of pyroxenite (7.8 million tons in fiscal 1968).[31]

Gold Fields of South Africa Ltd. planned a 100,000-ton-per-year sulfuric acid plant at its West Driefontein gold mine for use in uranium extraction.

Triomf Fertilizer and Chemical Industries Ltd.'s third phosphoric acid plant, at Potchefstroom, Transvaal, was on stream in January at a rate of 500,000 tons per year. This plant will permit production of triple superphosphate.

Zinc Corp. of South Africa Ltd. (ZINCOR) was building a $2.8 million sulfuric acid plant at the site of its new electrolytic zinc refinery near Springs, Transvaal. Raw material will be pyrite from the Areachap mine in northern Cape Province.

Fluorspar.—According to estimates of the Department of Planning, reserves of fluorspar containing more than 40 percent CaF_2 were in excess of 26 million tons at year-end, and reserves at 15 to 20 percent CaF_2, minable by open pit, were more than 200 million tons.[32]

Production and export sales of both acid and metallurgical grades increased substantially during 1969. Transvaal Mining and Finance Co. Ltd., a subsidiary of the General Mining group, continued mine and mill expansion. Large reserves of medium-grade ore, amenable to open pit mining, have been established at its Buffalo mine, about 60 kilometers north of Johannesburg.

Mica.—New equipment, installed at the Gravelotte mine, near Phalaborwa, is expected to increase recovery and double exports from the mine. It incorporates a dry grinding unit in the recovery circuit, permitting recovery of flaked material previously lost.[33]

Sulfur and Pyrite.—Sulfur consumption was 420,000 tons,[34] 92 percent of which was absorbed in sulfuric acid for the fertilizer and uranium industries. Pyrite for sulfuric acid is recovered at 11 gold mines and one tin mine, in addition to base metal sulfide mines. Seven pyrite-burning plants are controlled by the Acid Distribution Committee of the Chamber of Mines. There is also an independent plant at West Rand Consolidated Mines Ltd. Sulfur is also recovered from smelter gases at Palabora Mining Co. Ltd. and ZINCOR. Recent important mines under development for pyrite are the Prieska and Areachap, both in northern Cape Province. The former is operated by Africa Triangle Mining Co. (Anglo Transvaal, Middle Witwatersrand, and United States Steel). The latter was developed by ISCOR, which has an interest in ZINCOR.

Vermiculite.—Palabora Mining Co. Ltd., Vermiculite Division, increased production and export sales in 1969. The company planned to further expand and modernize its mining, milling, and bulk stockpiling facilities. Exploration was in progress to establish total reserves.

MINERAL FUELS

Coal.—Production of both bituminous and anthracite coal continued to gradually expand during 1969. Demand remained high, particularly for a number of new thermal power stations. Long-term contracts were made for coal supply to additional power stations under construction or in the planning stage. In 1969 coal consumption was as follows, in percent: Power generation 49.6; metallurgical industries 10.6; other industry 21.2; railways 10.2; and mines and local merchants 8.4.

The benefits of price increases granted late in 1968, the first since 1965, were evident in financial returns of most coal companies, although working costs continued to rise. Early in 1969, average values (per short ton) at mine for domestic markets were $2.46 for bituminous and $5.38 for

[29] Sulphur. No. 85, November–December 1969, pp. 9 and 25.
[30] Mining and Minerals Engineering. V. 5, No. 5, May 1969, p. 57.
[31] Industrial Minerals. No. 28, January 1970, p. 36.
[32] Republic of South Africa, Dept. of Planning. Personal Communication to Roderick G. Murchison, Regional Minerals Officer, U.S. Consulate General, Johannesburg, Mar. 17, 1970.
[33] South African Digest. Nov. 28, 1969, p. 5.
[34] South African Mining and Engineering Journal. V. 80, No. 3985, June 20, 1969, pp. 1371–1377.

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anthracite, $0.21 and $0.34, respectively, more than 1 year earlier. Export prices were $5.26 for bituminous ($4.89 in 1968) and $11.07 for anthracite ($10.18 in 1968).

New mines were opened or under development, and several operating mines were undergoing expansion. Anglo American Corp. produced 14.8 million tons in 1969, a slight reduction from 1968. However, the higher prices granted for both coal and coke resulted in higher profits. Arnot Colliery (Pty.) Ltd., a new Anglo American subsidiary, had a new, fully mechanized mine under development for 6.5 million tons annually in the eastern Transvaal. Shaft Sinkers (Pty.) Ltd. was awarded a contract for three inclined shafts and one vertical shaft. A second vertical shaft and a fourth inclined shaft will be sunk later. Arnot Colliery received a contract to supply coal for the new Arnot power station under construction for the Electricity Supply Commission.[35]

South African Coal Estates, also in the Anglo American group, started an expansion program to increase coal output by 18,000 tons per month at the Landau No. 3 extension mine. The $2.4 million, 300-meter Nicholson inclined shaft was completed in August. A conveyor belt system, 2,670 meters long and 42 inches wide, was installed. The belt speed is 140 meters per minute, and peak capacity is over 600 tons per hour.[36]

Anglo American's Springfield Colliery completed its Vlei shaft, and new mine capacity is 3.3 million tons per year. The mine provides coal for the new Grootvlei power station.[37]

Trans-Natal Coal Corp. Ltd., a subsidiary of General Mining and Finance Corp., continued development of the country's first open pit coal mine as part of the Optimas operation in the eastern Transvaal. Mine expansion was planned in three stages. The first stage included primary and secondary crushing plants and a conveyor system. Shaft sinking also was underway. For the open pit, a Marion 8000 bucket dragline (55-cubic-yard bucket, 275-foot boom) for stripping overburden was ordered in the United States.[38] The colliery will provide coal for the new Hendrina power station. Ultimate capacity is 225,000 tons per month. Initial mining was scheduled for 1970.

In an effort to supplement anthracite production, Johannesburg Consolidated Investment Co. Ltd. was investigating a prospect in Zululand, about 240 kilometers north of Durban. In November a shallow shaft had been sunk, and exploratory development of three seams was underway.

Longwalling methods continued at ISCOR's Durnacol mine, northern Natal Province. The first panel, about 140 meters wide, was extracted in the lower seam. The operation lasted 6 months and produced 112,000 tons of run-of-mine coal. During 1968 a larger panel was mined in an upper seam. Experimental longwalling began at Durnacol in 1965.

Petroleum and Natural Gas.—*Exploration.*—Several offshore concession holders completed preliminary surveys during 1969 and planned offshore drilling programs. In March, South Africa Superior Oil Co. Ltd., operator for a four-company group also including Africa Cities Service Ltd., South Africa Highlands Oil Co. Ltd., and Tenneco South Africa Ltd., struck natural gas in its first offshore well, 60 kilometers off Plettenberg Bay. The well was drilled from the Glomar Sirte platform in water 117 meters deep. The open-flow potential is 25 million cubic feet per day and 100 barrels per day of condensate from one zone and a minimum of 10 million cubic feet per day from a second, deeper zone.[39] A second well, 4.4 kilometers southeast of the first, was dry, and a third was planned.

Offshore drilling during 1969–70 was planned by Placid International Oil Co., Total Exploration (Pty.) Ltd., a Shell-BP-Compagnie Française des Pétroles-Mobil consortium, and Midlands Oil (Pty.) Ltd. Late in the year, the Midlands concession reportedly was ceded to U.S. Natural Resources, Inc., of California, which will provide a drilling rig. In November, Rand Mines Ltd. assumed a 52.5-percent interest in the Natural Resources Inc. concession, and Southern Oil Exploration Corp. (Pty.) Ltd. (SOEKOR), the South African Government agency, took a 50-percent participation in the Rand Mines share.

Onshore, SOEKOR increased exploration activities in the 350,000 square miles over

[35] Page 287 of source cited in footnote 17.
[36] Mining Journal. V. 273, No. 7006, Nov. 28, 1969, p. 491.
[37] Coal, Gold and Base Minerals. V. 17, No. 5, May 1969, pp. 17–19.
[38] Coal, Gold and Base Minerals. V. 16, No. 12, February 1969, pp. 15–21.
[39] Oil and Gas International. V. 9, No. 5, May 1969, pp. 121–122.

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which it holds a mandate. The company had geologic, geochemical, and seismic teams in the Orange Free State, Natal, and southern Transvaal, and was drilling at four locations late in the year. SOEKOR was joined by Syracuse Oils Co. Ltd., HM Mining Ltd., and Oceana Petroleum Corp. Ltd. in a 40,000-square-mile area of the northern Karroo, Orange Free State and Natal Province. Midlands, Gulf Eastern Oil Co. Ltd., and Zululand Oil Co. Ltd. also conducted surveys in leased onshore areas.[40]

Pipelines.—The $60 million, 830-kilometer, 18-inch crude oil pipeline, connecting the Richards Bay tanker terminal to Sasolburg and refineries near the Witwatersrand industrial area, was opened in June. Crude oil capacity was reported at 6 million tons per year (about 44 million barrels). The line also will serve the new Sasolburg refinery, which is scheduled for completion in 1972.

A 3-kilometer, 50-inch crude oil line will connect a single-buoy mooring station at Reunion to a $2-million, 7-tank farm (capacity 2.5 million barrels) and the Durban refineries of Shell-BP and Mobil, who jointly sponsored the project. The line was expected to be opened early in 1970.[41] The mooring station will handle 200,000-ton tankers and off-load crude oil at a maximum rate of about 100,000 barrels per hour.

Refineries.—The $22 million extension to the Caltex refinery at Milnerton, near Cape Town, included a fluid catalytic-cracking unit, vacuum unit, kerosine hydrotreater, two naphtha plants, a liquefied petroleum gas (LPG) plant, and increased capacity of the diesel hydro-unit and the sulfur plant. Completion was scheduled for April 1970.[42]

At the Shell-BP Durban refinery, catalytic-cracking and hydrofluoric alkylation units were installed as part of a $28-million project. The "catcracker" was designed to increase gasoline yield to about 55 percent of crude oil throughput.

National Petroleum Refiners of South Africa (Pty.) Ltd. (NPR) awarded contracts for its new $85 million, 50,000-barrel-per-day inland refinery, near Sasolburg, and construction was underway at yearend. NPR is a joint venture between South African Coal, Oil, and Gas Corp. (SASOL), Total Refining South Africa Ltd., and National Iranian Oil Co. (NIOC).

The South African Torbanite Mining and Refining Co. Ltd. reported output of 25.6 million gallons of crude oil from oil shale in 1969. Production is maintained at about the same level, according to an agreement with the oil companies.

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[40] Petroleum Press Service. V. 36, No. 5, May 1969, pp. 188–189.
[41] South African Digest. Aug. 29, 1969, p. 16.
[42] South African Digest. Oct. 17, 1969, p. 6.

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The Mineral Industry of the Territory of South-West Africa

By Walter C. Woodmansee [1]

Although specific data are lacking on activities in most sectors, the mineral industry apparently continued to contribute importantly to the economy of the Territory of South-West Africa. Tsumeb Corp. Ltd. and The Consolidated Diamond Mines of South-West Africa Ltd. (CDM), the two major mineral producers in the Territory, maintained a high level of operations. Tsumeb metal sales totaled $58.4 million in fiscal 1969 (ending June 30, 1969).[2 3]

At yearend there were 18 producing companies, 19 producing mines, 44 active exploration projects, and 101 mineral concessions in force, including petroleum.[4] Etosha Minerals (Pty.) Ltd., related to Etosha Petroleum Co. (Pty.) Ltd., which is a subsidiary of Brilund Mines Ltd., Canada, continued a drilling program for copper and base metals; it was considering a $20-million investment in a mining and processing operation near Grootfontein.[5]

United States Steel Corp. concluded an agreement with Anglo Transvaal Consolidated Investment Co. Ltd. for joint exploration projects in the Territory. Exploration for copper and base metals was underway at Witvlei at yearend. Falconbridge Nickel Mines Ltd., Canada, also was involved in an exploration project for copper through a subsidiary in the Territory. Two new zinc mines were at or near full-scale operations, providing a zinc concentrate for a new electrolytic refinery in South Africa. The Rio Tinto group is involved in an exploration program for uranium in the west-central part of the Territory and, after 2 years of investigation, reportedly has a large low-grade deposit amenable to open-pit development.

In the petroleum sector, exploration agreements were concluded with a number of companies which were granted marine and land concessions, and most operating companies had exploration programs in progress during the year.

PRODUCTION AND TRADE

The South-West Africa Administration, Republic of South Africa, continued its policy of not disclosing mineral production statistics for the Territory. The only available statistical data on production were derived from annual reports of the two major companies operating in the Territory—Tsumeb Corp. Ltd. and CDM. The Territory traditionally produces a large variety of other minerals, particularly nonmetals, but output data are not available, and these commodities are not listed in table 1.

Tsumeb operations during fiscal 1969 were approximately on the same level as in fiscal 1968. The company is a steady supplier of arsenic, cadmium, copper, lead, silver, and zinc to world markets. CDM increased its output of gem diamond as an expansion program continued. Although statistics are not available, zinc production apparently is expanding as two new mines recently completed development.

[1] Physical scientist, Bureau of Mines, Washington, D.C.

[2] Tsumeb Corp. Ltd. Twenty-Third Annual Report, New York, New York, p. 1.

[3] Where necessary, values have been converted from South African rands (R) to U.S. dollars at a rate of R1 = US$1.40.

[4] South African Digest, Mar. 6, 1970, p. 5.

[5] American Metal Market, v. 77, No. 21, Jan. 30, 1970, p. 11.

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The territory's foreign trade in mineral commodities is included in trade statistics for the Republic of South Africa and cannot be differentiated. Most mineral commodities produced in the Territory are either processed in South Africa or shipped to world markets.

Table 1.—South-West Africa: Production of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Arsenic, white [2]	e 300	484	---
Cadmium:			
Mine output, metal content, recoverable [2]	256	214	231
Metal, refined [2]	166	168	191
Copper:			
Mine output, metal content, recoverable [2]	32,888	31,471	27,624
Metal, blister [2]	34,187	32,892	27,482
Lead:			
Lead-vanadium concentrate	9,830	6,640	NA
Mine output, metal content, recoverable [2]	70,766	56,179	60,449
Metal, refined [2]	73,553	61,193	60,859
Silver, mine output, metal content, recoverable [2] thousand troy ounces	1,450	1,350	1,273
Tin:			
Concentrate e long tons	730	750	750
Concentrate, with tungsten do	631	628	e 630
Vanadium, metal content, lead-vandate concentrate e	980	r 510	410
Zinc, mine output, metal content e thousand tons	40	60	70
NONMETALS			
Diamond: [3]			
Gem e thousand carats	r 1,633	r 1,636	1,924
Industrial e do	r 68	r 86	100
Total do	1,701	1,722	2,024
Sulfuric acid [2]	1,538	1,531	1,334

e Estimate. r Revised. NA Not available.

[1] A number of other mineral commodities are produced in South-West Africa, but quantitative data are not available.

[2] Production by Tsumeb Corp. Ltd. for fiscal years ending June 30.

[3] Production by Consolidated Diamond Mines of South-West Africa Ltd. For 1969, includes 184,000 carats produced by Tidal Diamonds (SWA) Ltd.

COMMODITY REVIEW

METALS

Tsumeb Corp. ore capacity reached 650,000 metric tons at the Tsumeb mine as expansion continued. Preparations were made for sinking the No. 7 internal shaft from the 36 level to the 45 level. Three stopes were in production on the 34 level, and two stopes were in preparation. A total of 9,700 meters of underground diamond drilling was completed during the fiscal year. At the Tsumeb West project, 5,830 meters of diamond drilling and 450 meters of percussion drilling were completed.

At Kombat, production continued from the West, Central, and East orebodies. At the West deposit, a cut-and-fill stope was started on the fourth level; at the Central deposit two stopes were in production; and at the East deposit, production was from the fourth and sixth levels. A total of 13,530 meters of underground diamond drilling, 1,885 meters of surface diamond drilling, and 1,085 meters of percussion drilling was completed in the Kombat area during the fiscal year.

In general exploration, Tsumeb Corp. investigated several prospects in various parts of the Territory. Three prospecting leases were granted to Tsumeb in the Otavi Mountainland, and reconnaissance mapping, geochemical work, and shallow percussion drilling were underway. Exploratory drilling projects continued in Otavi Valley, Asis Ost, Harasib Valley, Rietfontein, and Alt Bobos.

Tsumeb Corp. concluded a joint venture agreement with The South-West Africa Co. Ltd. (SWACO) which granted certain exploration rights to Tsumeb. The company also participated with Anglo Transvaal Consolidated Investment Co. Ltd. in several companies and with Terra Marina Mining Co. Ltd. in the Rehoboth district.

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Table 2.—South-West Africa: Salient production statistics of Tsumeb Corp. Ltd.

		Year ending June 30	
		1968	1969
Tsumeb mine and mill:			
Ore mined, gross weight	short tons	635,508	606,116
Ore milled, gross weight	do	634,303	569,394
Metal content of ore:			
Copper	percent	4.61	4.46
Lead	do	10.29	11.35
Zinc	do	2.99	3.37
Silver	ounces per short ton	2.13	1.70
Concentrate production:			
Lead concentrate:			
Gross weight	short tons	120,309	138,109
Metal content:			
Copper	percent	7.76	6.03
Lead	do	46.53	44.09
Silver	ounces per short ton	3.76	2.92
Copper concentrate:			
Gross weight	short tons	44,321	20,218
Metal content:			
Copper	percent	38.45	41.71
Lead	do	9.60	10.28
Silver	ounces per short ton	17.49	22.68
Zinc concentrate:			
Gross weight	short tons	11,500	9,824
Metal content:			
Zinc	percent	52.04	51.51
Cadmium	do	1.08	1.11
Kombat mine and mill:			
Ore mined and milled:			
Gross weight	short tons	823,624	411,864
Metal content:			
Copper	percent	2.86	1.65
Lead	do	1.31	1.79
Silver	ounces per short ton	0.48	0.30
Concentrate production:			
Copper concentrate:			
Gross weight	short tons	26,671	24,787
Metal content:			
Copper	percent	32.79	23.44
Lead	do	4.69	4.75
Silver	ounces per short ton	4.96	3.11
Lead concentrate:			
Gross weight	short tons	4,448	9,941
Metal content:			
Copper	percent	5.94	6.17
Lead	do	62.03	57.65
Silver	ounces per short ton	0.99	1.35
Smelting and refining:			
Direct smelting ore	short tons	944	34,408
Average assay:			
Copper	percent	28.57	24.66
Lead	do	5.02	3.76
Silver	ounces per short ton	10.90	9.69
Copper concentrates smelted	short tons	71,755	44,655
Average assay:			
Copper	percent	36.32	31.53
Lead	do	7.78	7.23
Silver	ounces per short ton	12.68	12.04
Lead concentrates smelted	short tons	127,116	146,817
Average assay:			
Copper	percent	7.65	6.06
Lead	do	47.65	44.88
Silver	ounces per short ton	3.80	2.99

Arsenic.—A total of 8,215 tons of reverberatory and converter baghouse dusts were roasted at Tsumeb, resulting in 2,334 tons of black oxide during fiscal 1969. The arsenic refining furnaces were not operated during the year.

Cadmium.—Tsumeb Corp. processed 5,100 tons of blast furnace and sinter baghouse dust. Refined cadmium assayed 99.98 percent pure.

Copper.—Mine and smelter copper output at Tsumeb was at a slightly reduced rate compared with fiscal 1968. Sales of electrolytic copper, refined on toll, totaled 30,439 tons. Tsumeb Corp. continued development work at the Matchless copper-pyrite mine, 40 kilometers southwest of Windhoek. Production was scheduled for early 1970, although water supply was problematical. The Department of Water Affairs reportedly started dam construction for water storage in the area. The No. 1 Shaft was completed to 308 meters in June 1969. Surface buildings were under construction. A total of 7,170 meters of surface diamond drilling was

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completed during the fiscal year, largely in the western extension areas. Tsumeb Corp. carried Matchless reserves at 2.2 million tons of 1.8 percent copper on the basis of a 1 percent copper cutoff.

Falconbridge South Africa Exploration Co. Ltd., a subsidiary of Falconbridge Nickel Mines Ltd., Canada, carried on a $1.5-million exploration program at its prospect 50 kilometers south of Windhoek.[6] A 300-foot exploratory shaft was sunk, and a bulk sample was taken for metallurgical testing.[7] Annual production rate of 12,000 tons of concentrate and 6,000 to 7,000 tons of metal was scheduled for mid-1971.

Silver.—Tsumeb Corp. sold 1,673,053 ounces, largely refined on toll, during fiscal 1969. No commerical silver was produced at Tsumeb during the year.

Uranium.—Early in the year, the Minister of Mines of South Africa announced that Rio Tinto Management Services (South Africa) (Pty.) Ltd., the South African subsidiary of Rio Tinto Zinc Corp. Ltd., had been investigating a uranium deposit at Rossing, 60 kilometers east of Swakopmund, for 2 years. Diamond drilling indicated the existence of a large low-grade deposit, amenable to open-pit development.[8] Late in the year drilling continued, sinking of a 350-foot shaft was underway, and a pilot plant for metallurgical testing was under construction. If the deposit proves economic, it was proposed that a company controlled by the Industrial Development Corp., a Government agency, be formed.

Zinc.—The expansion program was completed by SWACO at its Berg Aukas mine. The main shaft was sunk to 520 meters and was designed for a depth of 760 meters. Mining capacity is 50,000 tons per month.[9] Two new ore treatment plants, costing $8.5 million and built by Lurgi South Africa Co. Ltd., are on stream. The product is zinc oxide at a rate of 120 tons per day, using residues from the flotation plant.

The Rosh Pinah mine of Incor Zinc (Pty.) Ltd., a subsidiary of the South African Iron and Steel Industrial Corp. Ltd. (ISCOR), went into full-scale production in May at a rate of 200 tons of zinc concentrate per day and 40 tons of copper-lead concentrate per day.

The products of the Berg Aukas and Rosh Pinah mines are shipped to Springs, Transvaal, in the East Rand, where South Africa's first electrolytic zinc plant was recently completed.

NONMETALS

Diamond.—According to the 1969 Annual Report of CDM, a member of the De Beers group, operations were expanded during the year, although mining grade and average diamond size were slightly reduced. In the northern onshore area, the No. 1 treatment plant, the first of four planned, was operated throughout the year in excess of designed capacity. The crushing plant is capable of crushing conglomerate, which formerly had been stockpiled. The use of heavy-media separation replaced jigging, and recovery of small diamonds was increased. Vibrating feeders, capable of handling 800 tons of conglomerate per hour with three feeders in use, were installed to replace the nonvibrating type, which did not provide a steady flow of the conglomerate.[10]

The No. 4 onshore plant was partially completed. It includes facilities for dump treatment, field screening, conglomerate crushing, and final diamond recovery. The dump treatment unit was completed late in the year, and 54,581 carats were recovered from the dumps. The field screening unit, for treating gravels, also was completed. Extensions were added to the recovery plant. The conglomerate-crushing plant, CDM's second, will be operational in 1970.

In the foreshore area, CDM employed new techniques in beach mining as operations extended seaward, following introduction of a system using interlocking concrete prisms to protect the seaward sand walls. The prisms, weighing 8-11 tons each, are laid on a gravel base in the surf zone. This method permitted mining and processing of 53,378 cubic meters of gravels from beach seaward extensions.

In offshore areas, leased by CDM from The Marine Diamond Corp. Ltd. (MDC),

[6] Steel. V. 165, No. 23, Dec. 8, 1969, p. 29.
[7] Mining Journal. V. 273, No. 7001, Oct. 24, 1969, p. 375.
[8] South African Mining and Engineering Journal. V. 81, No. 4036, May 16, 1969, p. 1077.
[9] Engineering and Mining Journal. V. 170, No. 6, June 1969, p. 308.
[10] South African Mining and Engineering Journal. V. 80, No. 3990, July 25, 1969, p. 197.

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Table 3.—South-West Africa: Operations of The Consolidated Diamond Mines of South-West Africa, Ltd.

Operation	Onshore		Foreshore		Offshore		Totals and averages	
	1968	1969	1968	1969	1968	1969[1]	1968	1969
Overburden stripped----thousand cubic meters--	14,051	17,908	2,485	2,787	XX	XX	16,536	20,695
Deposits mined and treated----do----	4,642	5,771	522	507	76	14	5,240	6,292
Production----carats--	1,490,073	1,696,702	149,765	124,649	82,421	19,128	1,722,259	1,840,479
Grade----carats per cubic meter of deposit treated--	0.32	0.29	0.29	0.25	1.08	1.34	0.33	0.29
Average diamond size----carats--	0.84	0.65	0.52	0.52	0.50	0.39	0.80	0.64
Cost per cubic meter of deposit treated----dollars--	3.29	3.05	4.41	4.55	47.70	41.78	4.05	3.26
Cost per carat recovered----do----	10.23	10.37	15.37	18.54	44.06	31.14	12.30	11.14

XX Not applicable.
[1] Two months only.

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the dredging barge *Pomona* worked in the vicinity of Chameis Bay only during January and February. In March it was transferred temporarily to Hottentot Bay to the north, where it worked in the concession area of Tidal Diamonds S.W.A. (Pty.) Ltd. (CDM two-thirds, Getty Oil Co. one-third). Tidal Diamonds produced 183,813 carats during 1969. The prospecting vessel *Cypress* did seismic profiling along 50 kilometers of coastline, and the vessel *Rockeater* carried out reconnaissance and detailed sampling.

Sulfuric Acid.—The plant at Tsumeb was operated intermittently during the year to supply acid for Tsumeb and Kombat operations and for Tsumeb Corp. customers. Pyrite from the Matchless mine, under development by Tsumeb Corp., will be used in the manufacture of sulfuric acid.

MINERAL FUELS

Petroleum.—Private concession holders concluded agreements with Southern Oil Exploration Corp. (South-West Africa) (Pty.) Ltd. (SWAKOR), a Government agency established by the South-West Africa Administration. Several companies completed onshore and offshore reconnaissance surveys; other companies planned or started projects. The entire coastal area was under concession, except for the extreme southern end, which was held as a diamond lease by MDC. Chevron Oil Co. of South-West Africa Ltd. and Regent Petroleum South-West Africa Ltd. (a subsidiary of Texaco, Inc.) reportedly concluded a prospecting agreement with MDC. This agreement was submitted to the Minister of Mines for approval. Late in the year, BP Development Co. of South Africa Ltd. completed a reconnaissance seismic and aeromagnetic survey and started an offshore seismic survey in its concession north of Walvis Bay. Shell Exploration South Africa (Pty.) Ltd., partner with BP in three concessions, also conducted an airborne geophysical survey. Etosha Petroleum Co. (Pty.) Ltd., controlled by the Canadian-based Brilund Mining Co., had one drill rig working in the Etosha Game Reserve and planned to move a second rig to its large concession area in the north. Société Nationale des Pétroles d'Aquitaine, operator for its joint onshore concession with De Beers Consolidated Mines Ltd., started exploration in the Keetmanshoop area at midyear.

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The Mineral Industry of Southern Rhodesia

By Henry E. Stipp [1]

The Southern Rhodesian mineral industry reportedly had a record year in 1969, with output valued at an estimated $173.6 million [2] compared with $133.8 million in 1968.[3] Mineral production also has been diversifying. The rate of royalty payment, which was changed to a unit weight basis, was expected to further stimulate mining by providing a rebate of up to 100 percent for locally processed or consumed minerals. Exploration activity continued to rise with 70 companies surveying on exclusive prospecting orders. In 1969 exclusive prospecting orders totaled 92 compared with 52 in 1968. A map was published, showing the type of mineral sought and areas being prospected under exclusive prospecting orders.[4] An agreement was signed between the Ministry of Mines and the University College of Rhodesia establishing an Institute of Mining Research at the College.[5] The institute will do research work on basic mining and metallurgical problems.

The Rhodesian Government reorganized the Ministry of Mines and Lands, and appointed a Minister of Mines with a seat in the cabinet.[6] The Minister of Mines will plan and supervise expansion in the mineral industry, which has been described as the most promising sector of the Southern Rhodesian economy. Conversely, the President of the Chamber of Mines of Rhodesia reported that the mining industry had as many problems arising from sanctions as other sectors of the economy.[7] Production and mining costs were said to be rising while selling prices were static or falling. Marketing problems were complicated by the need to sell despite sanctions. The Government program of investment in the public sector authorized a total of $2.73 million for the mineral industry during the 1969–72 fiscal period.[8]

Official statistical information on mineral production and trade has not been available since yearend 1965. Estimated production of selected minerals for 1967 and 1968 are shown in table 1. Although trade in minerals has not been officially reported, total domestic exports in 1969 were valued at $220.1 million compared with $174.7 million in 1968. Total imports were valued at $198.6 million in 1969 compared with $207 million in 1968.[9]

The manufacturing plant of Aluminum Industries Ltd., being constructed in the Willowvale area near Salisbury, was expected to begin fabricating aluminum tubing and foil by yearend. Alcan Aluminium of Rhodesia also manufactured aluminum building sheets at its plant located in Salisbury.

Large deposits of copper reportedly were discovered recently in the Headlands area between Salisbury and Umtali and also 90 miles from Bulawayo near the Botswana border.[10]

Messina (Transvaal) Development Co. Ltd. purchased two low-grade copper deposits in the Lomagundi area near Alaska. In the fiscal year ending September 1969,

[1] Physical scientist, Bureau of Mines, Washington, D.C.

[2] Where necessary, monetary values have been converted from Southern Rhodesia pounds (R£) to U.S. dollars at the rate of R£1=US$2.80.

[3] Standard Bank Review (London). Industrial Origin of the Gross Domestic Product. May 1970, p. 30.

[4] S.A. Mining and Engineering Journal (Johannesburg). Latest Rhodesian Prospecting. V. 80, No. 3969, Feb. 28, 1969, p. 472.

[5] Mining Journal. Rhodesian Research Institute. V. 273, No. 6990, Aug. 8, 1969, p. 120.

[6] U.S. Consulate, Salisbury. State Department Airgram A-1, Jan. 3, 1969, p. 1.

[7] U.S. Consulate, Salisbury. State Department Airgram A-105, May 23, 1969, p. 1.

[8] Industries et Travaux D'Outremer (Paris). Rhodésie. No. 188, July 1969, pp. 611–612.

[9] Page 29 of work cited in footnote 3.

[10] World Mining. World Mining Newsletter. V. 6, No. 1, January 1970, pp. 9, 11.

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Table 1.—Southern Rhodesia: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967 [1]	1968 [1]	1969
METALS			
Chromite	317,800	381,000	• 370,000
Copper, mine, content of ore and concentrate	18,000	18,000	• 24,000
Gold, troy ounces	519,877	499,943	• 480,000
Iron and steel:			
Iron ore, thousand tons	700	1,300	• 1,300
Pig iron, do	200	260	• 250
Steel ingots and castings, do	130	140	• 130
Nickel, content of concentrate •	700	1,000	8,000
Tin, mine content of concentrate, long tons	500	600	• 500
NONMETALS			
Asbestos	97,300	86,000	• 80,000
Lithium minerals	• 60,000	54,400	• 45,000
MINERAL FUELS (SALES)			
Coal, bituminous, thousand tons	3,060	3,273	3,332
Coke, do	205	221	243

• Estimated.
[1] Annales Des Mines (Paris). The Commercial Consul at the French Embassy in Rhodesia, Bureau of Mineral Documentation. September 1969, p. 80.

Messina Development produced 3,950 tons of copper from 380,000 tons of ore obtained from their Umkondo mine near Fort Victoria and their mine near Alaska.[11] The firm's subsidiary, MTD Mangula Ltd., in the same period produced 20,500 tons of copper from 1.42 million tons of milled ore and 684,000 tons of leached oxide ore. Mangula's reserves were estimated at 18 million tons of ore containing 1.37 percent copper. Development work was proceeding at Messina's Gwai River mine in the Wankie area where a total of about 32,000 feet of diamond drilling was completed in March. Total reserves were estimated at 1.28 million tons of ore containing 2.13 percent copper. The mine, with a scheduled capacity of 216,000 tons per year, was expected to begin producing by early 1970. Development work on Messina's Shackelton mine, located near Sinoia 100 miles northwest of Salisbury, was delayed by large flows of water into the shaft. Despite this handicap, the mine was scheduled to begin producing ore by 1973 at a rate of 600,000 tons per year. Ore reserves were estimated at 4.4 million tons of 1.42-percent-copper content. London and Rhodesia Mining and Land Co. Ltd. was working in the Inyati area on copper indications.

The Delcia gold mine, which was purchased by Falcon Mines Ltd., will provide additional ore for Falcon's adjoining Arlandzer mine and mill.[12] Olympus Mines Ltd., an affiliate of Falcon Mines, purchased the Dawn mine in the Bulawayo area. The company also was prospecting for gold, tungsten, nickel, and emeralds. The Shamva gold mine, which produced from 1909 to 1930, was being reactivated with the sinking of a new shaft and installation of $840,000 of new plant, equipment, and housing.[13] Homestake Mines (Pvt.) Ltd. will work the mine at a rate of about 72,000 tons of ore per year. Expected yield was estimated at 0.25 troy ounce of gold per ton. The mine was slated to employ about 20 European staff personnel and from 300 to 400 African workers. Drilling at the Penhalonga mine near Umtali has indicated the presence of a new gold-bearing strata.[14] Rhodesian gold production during the past 20 years reportedly has been at a constant rate of from 500,000 to 600,000 ounces per year.

The Trojan mine at Bindura and the Madziwa mine near Shamva were expected to produce about 1.2 million tons of nickel ore in 1969, which would yield 7,500 tons of nickel metal, and also copper and cobalt metal. Concentrates from the two mines will be processed in a 7,500-ton-per-year smelter at Bindura. The Cardiff Hill deposit near the Trojan mine has proved reserves of 10 million tons of ore containing 0.95 percent nickel. The Empress nickel copper mine of Rio Tinto (Rhodesia) Ltd. was worked to build up ore stockpiles and perform experimental and pilot plant operations. In early 1969 the main shaft of the mine was 1,000 feet

[11] Mining Journal (London). Rhodesia. V. 274, No. 7013, Jan. 16, 1970, pp. 53, 54.
[12] World Mining. Rhodesia. V. 5, No. 6, June 1969, p. 48.
[13] U.S. Consulate, Salisbury. State Department Airgram A-105, May 23, 1969, p. 2.
[14] Work cited in footnote 10.

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deep. Development work was being carried out at the 450- and 750-foot levels.[15] Concentrates containing 88 percent nickel and 94 percent copper are pumped to smelter storage from a 50-foot-diameter thickener. The concentrates are fluxed and smelted in a reverberatory furnace to produce matte containing 90 percent nickel and copper. The Empress mine is slated to reach full production of 720,000 tons of ore per year by 1972. Reserves were estimated at 15.8 million tons of ore containing 0.81 percent nickel and 0.62 percent copper. An Exclusive Prospecting Order for nickel in 18 square miles of the Gwelo district was requested by Globe and Phoenix Gold Mining Co.[16] The firm operates a gold mine near Que Que. In the Matabeleland area 38 Exclusive Prospecting Orders were granted to major firms to prospect for nickel, nickel and copper, and nickel and cobalt.[17]

Production of tungsten (scheelite) concentrates at the Messina (Transvaal) Development Co. Ltd. mine near Beardmore was scheduled to begin in mid-1970.[18] Production capacity was estimated at 36,000 tons per year. The scheelite ore will be concentrated to 68 percent tungsten trioxide (WO_3). Ore reserves reportedly were 103,000 tons with WO_3 content of 1.28 percent.

The first unit of the nitrogen chemical fertilizer complex, located near Que Que, started producing in mid-1969.[19] This unit consists of a nitric acid plant and an ammonium nitrate plant, which consume purchased ammonia. The output capacity of the fertilizer units reportedly were 180,000 tons ammonium nitrate per year. Initial production was expected to be 60,000 tons in 1969; however, this output goal may not be reached because some calcium ammonium nitrate was imported. The second stage of the chemical fertilizer complex, which consists of an ammonia plant of 90,000- to 95,000-tons-per-year capacity, was to be constructed in 18 to 24 months. Stage three of the project, consisting of plant expansion, will begin in 1971.

A very large emerald weighing 1,160 carats was found in the Chikwanda mine near Fort Victoria.[20] The emerald was a piece of a larger crystal, which has not been found. The emerald was considered to be a collector's item since the stone was flawed and not suitable for jewelry.

[15] Skillings' Mining Review. Rhodesia's Nickel Mine Being Developed. V. 58, No. 39, Sept. 27, 1969, p. 16.
[16] Metal Bulletin (London). Nickel-Rhodesian Search. No. 5401, May 23, 1969, p. 25.
[17] U.S. Consulate, Salisbury. State Department Airgram A-4, Jan. 9, 1970, p. 1.
[18] Work cited in footnote 11.
[19] European Chemical News (London). Rhodesia Opens Fertilizer Plant. V. 16, No. 396, Sept. 5, 1969, p. 10.
[20] U.S. Consulate, Salisbury. State Department Airgram A-280, Jan. 2, 1970, p. 1.

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The Mineral Industry of Spain

By F. L. Klinger [1] and J. B. Huvos [2]

The Spanish mineral industry continued to grow in 1969. Rising domestic demand resulted in increased production and imports of many commodities, and apparently led to reduced exports of others such as zinc and petroleum products. Significant increases in productive capacity were being realized or planned in several sectors, notably aluminum, copper, iron and steel, mercury, cement, fertilizer materials, pyrite, and petroleum products. Sharp reductions in the number of operating mines in the coal and iron ore sectors were indicative of the industry's efforts to increase efficiency.

In 1969 the Government began an intensive 2-year survey of the country's mineral resources (including the Continental Shelf) and potential markets for mineral commodities, coordinated through the Ministry of Industry. Government companies and research organizations were participating or cooperating with private firms in many areas of mineral exploration and research. Iron ore and coal were high on the list of priorities, but considerable attention was being given to promising deposits of nonferrous metals and industrial minerals including diamond.

In other developments, Spain's eighth petroleum refinery was commissioned and its second commercial nuclear powerplant was nearing completion.

[1] Physical scientist, Bureau of Mines, Washington, D.C.
[2] Foreign mineral specialist, Bureau of Mines, Washington, D.C.

PRODUCTION

Indices of production for various branches of the mineral industry in 1968 and 1969 were as follows:

Sector	(1962 = 100)	
	1968 r	1969
Mining:		
Coal and lignite	98.7	98.1
Metallic ores	102.7	104.0
Nonmetals [1]	168.7	177.9
Manufacturing:		
Iron and steel	239.4	293.2
Nonferrous metals	163.0	172.0
Fertilizers	189.8	172.3
Cement	227.7	242.0
Petroleum refining	327.6	353.5

r Revised.
[1] Minerals for manufacture of fertilizers and chemicals.

Source: Boletín Mensual de Estadística (Madrid). V. 31, No. 307, July 1970, pp. 55–64.

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Table I.—Spain: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Aluminum:			
Bauxite	4,757	• 5,800	• 5,000
Metal, primary	85,032	89,322	103,070
Antimony:			
Mine output, metal content	r 121	r 132	r 122
Metal (regulus)	265	197	NA
Arsenic, white	r 126	130	• 100
Bismuth, mine output, metal content—kilograms	r 3,638	r 6,000	• 6,000
Cadmium, metal [1]—do	67,000	70,000	80,000
Copper:			
Mine output, metal content	8,561	8,365	10,196
Metal:			
Blister	29,003	r 45,777	37,620
Refined:			
Electrolytic	72,243	78,099	76,024
Fire-refined	5,169	5,486	
Gold, metal—troy ounces	932	NA	NA
Iron and steel:			
Iron ore and concentrate—thousand tons	5,067	6,185	6,253
Pig iron—do	2,687	2,779	3,333
Ferroalloys—do	80	97	93
Steel ingots and castings—do	r 4,512	5,019	5,950
Steel semimanufactures:			
Hot rolled:			
Heavy sections—thousand tons	1,495	874	933
Light sections—do		1,035	1,203
Wire rod—do	r 403	482	614
Sheets and plates—do	1,065	1,348	1,624
Hoop and strip—do	201	204	218
Railway track material—do	82	70	92
Blanks for tubes—do	49	75	130
Other—do	• 30	33	24
Total hot rolled—do	• r 3,325	4,121	4,838
Other:			
Castings and forgings, rough—do	NA	160	164
Cold-rolled sheet—do	381	542	697
Tinplate—do	58	106	132
Galvanized sheet—do	NA	NA	70
Magnetic sheet—do	26	NA	36
Lead:			
Mine output, metal content	r 68,691	r 74,045	69,581
Metal, primary	52,560	r 64,125	81,155
Manganese ore and concentrate	r 8,466	12,926	22,954
Mercury:			
Mine output, metal content—76-pound flasks	r 49,740	r 56,943	75,769
Metal—do	r 48,490	• r 55,500	64,456
Silver, metal—thousand troy ounces	2,218	1,736	• r 2,400
Tin:			
Mine output, metal content—long tons	r 160	r 140	123
Metal, primary—do	1,823	r 2,323	2,066
Titanium:			
Ilmenite concentrates	r 37,072	39,538	29,457
Dioxide	11,471	11,910	12,688
Tungsten:			
Mine output, metal content	80	124	71
Metal	96	NA	NA
Uranium:			
Mine output, metal content	99	• 100	NA
U_3O_8 production [2]	60	60	50
Zinc:			
Mine output, metal content	r 57,876	r 74,598	80,799
Metal, primary	70,407	r 75,386	80,298
NONMETALS			
Barite	50,129	• 67,000	• 60,000
Cement, hydraulic:			
Natural—thousand tons	339	• 300	• 300
Other—do	13,138	r 14,907	16,012
Chalk—cubic meters	89,091	89,087	• 90,000
Clays:			
Bentonite	16,421	27,080	• 25,000
Kaolin and china clay	216,018	226,694	• 225,000
Other—thousand cubic meters	3,354	3,753	NA
Diatomite and tripoli	17,131	• r 10,000	NA
Earths, industrial, n.e.s	14,693	12,049	NA
Feldspar	47,459	47,269	• 50,000

See footnotes at end of table.

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Table 1.—Spain: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
NONMETALS—Continued				
Fertilizer materials:				
Crude potash salts (K_2O content)		r 580,008	r 616,892	635,688
Manufactured:				
Nitrogenous, nitrogen content	thousand tons	382	454	357
Phosphatic, P_2O_5 content	do.	311	316	286
Potassic, K_2O content [2]	do.	534	r 573	• 584
Fluorspar (CaF_2 content):				
Acid grade	thousand tons	r 185	247	192
Metallurgical grade	do.	r 52		57
Gypsum and anhydrite, crude	do.	r 3,638	r 3,920	4,000
Lime (quicklime and hydrated lime)	do.	306	• 315	• 330
Magnesite, crude		123,134	• r 256,000	NA
Meerschaum (salable)		9,580	• 36,000	NA
Ochre		15,327	• 16,800	NA
Pumice		r 109,274	169,013	NA
Pyrite (including cupreous):				
Gross weight	thousand tons	r 2,328	2,403	2,475
Sulfur content	do.	1,087	r 1,150	1,149
Quartz		206,838	289,013	NA
Salt:				
Rock	thousand tons	847	911	• 925
Marine and other evaporated	do.	924	r 933	• 900
Stone, sand and gravel, n.e.s.:				
Stone, not further described:				
Calcareous:				
Dolomite	thousand tons	161	185	NA
Limestone	do.	17,343	19,813	NA
Marble	do.	140	144	NA
Marl and other	do.	2,464	2,578	NA
Quartzite	do.	193	363	NA
Sandstone	do.	567	554	NA
Granite, basalt, and other	do.	3,892	4,701	NA
Sand:				
Silica sand	do.	292	315	NA
Other	do.	871	1,063	NA
Gravel	do.	1,497	1,933	NA
Strontium minerals •		1,000	4,000	4,000
Sulfur, elemental, all forms [3]		42,110	r 36,921	• 40,000
Sulfates, natural:				
Glauberite, Na_2SO_4 content		8,110	8,978	NA
Thenardite Na_2SO_4 content		54,617	62,779	NA
Talc and steatite		31,920	29,027	• 30,000
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural (contained)		2,274	1,772	NA
Carbon black		r 12,500	• 25,000	NA
Coal:				
Anthracite	thousand tons	r 2,769	2,862	2,767
Bituminous	do.	r 9,595	r 9,460	8,817
Lignite	do.	r 2,666	2,832	2,736
Coke:				
Metallurgical	do.	2,963	3,522	3,692
Gas	do.	55	18	6
Fuel briquets, all types	do.	r 336	135	• 115
Gas, manufactured [4]	million cubic meters	536	r 628	• 715
Peat		7,606	8,746	• 8,000
Petroleum:				
Crude	thousand tons	84	150	193
Refinery products: [5]				
Gasoline, motor	do.	2,141	2,778	3,059
Naphtha, for industrial use	do.	1,281	1,546	1,725
Kerosine, including tractor fuel	do.	316	387	414
Jet fuel	do.	494	676	834
Distillate fuel oil	do.	4,805	6,264	6,601
Residual fuel oil	do.	10,526	13,211	14,096
Liquefied petroleum gases	do.	463	669	716
Lubricants	do.	124	140	199
Asphalt and bitumen	do.	610	634	704
Nonlubricating oils	do.	27	29	36
Paraffins	do.	5	7	10
Total [6]	do.	20,792	26,341	28,394

• Estimate. r Revised. NA Not available.

[1] World Bureau of Metal Statistics (London). World Metal Statistics. September 1970, p. 12.

[2] Including potassium sulfate.

[3] Includes refined, sublined, and "terrón."

[4] Not including gas produced in blast furnaces or petroleum refineries.

[5] Figures for 1967 and 1968 are revised; source is Anuario Estadistico de España-1969, p. 159. Source for 1969 is U.S. Embassy Madrid, despatch A-171, April 29, 1970.

[6] Not including refinery gas (276,000 tons in 1967, 418,000 tons in 1968, and 376,000 tons in 1969).

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TRADE

Spain's trade deficit in mineral commodities rose to nearly $990 million in 1969, more than 30 percent above the level of 1968. Unexpectedly heavy imports of iron and steel were largely responsible.

Exports of mineral commodities were valued at $289 million, slightly less than in 1968. Increased exports of crude minerals, construction materials, and iron and steel products were offset by declines in potash, copper, and petroleum products.

Substantial increases in imports of all major categories of mineral commodities except fuels pushed up the total value to approximately $1,278 million in 1969. The largest increase was registered in iron and steel products, which were valued at $327 million compared with $171 million in 1968. Crude oil and copper were the other two leading commodities, valued at $447 million and $119 million, respectively.

Mineral commodity trade in 1967 and 1968 is summarized in tables 2–5.

Table 2.—Spain: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum metal, including alloys:		
Scrap	113	193
Unwrought	11,108	6,504
Semimanufactures	4,628	7,080
Antimony metal, including alloys, all forms	-------	75
Cadmium metal, including alloys, all forms ..... kilograms	45,181	34,506
Copper:		
Matte	184	111
Metal, including alloys:		
Scrap	181	166
Unwrought and semimanufactures	36,150	35,121
Iron and steel:		
Iron ore, except roasted pyrite ..... thousand tons	814	1,170
Roasted pyrite ..... do	774	770
Metal:		
Pig iron, including cast iron ..... do	15	114
Ferroalloys ..... do	18	24
Steel, primary forms ..... do	(1)	2
Semimanufactures ..... do	52	125
Lead metal, including alloys, all forms	39	88
Magnesium metal, including alloys, all forms	16	21
Mercury:		
Oxides	139	161
Metal ..... 76-pound flasks	50,532	42,975
Nickel metal, including alloys, all forms	61	58
Selenium, elemental ..... kilograms	842	-------
Silicon, elemental	91	918
Tin metal, including alloys:		
Scrap ..... long tons	17	7
Unwrought and semimanufactures ..... do	96	284
Titanium:		
Ore and concentrate (ilmenite)	6,300	6,450
Oxides	4,865	3,193
Tungsten:		
Ore and concentrate	187	331
Metal, including alloys, all forms	26	7
Zinc:		
Ore and concentrate	12,617	6,926
Oxide	451	1,046
Metal, including alloys, all forms	13,909	22,399
Other:		
Ore and concentrate	8,505	6,781
Ash and residues containing nonferrous metals	12,518	20,027
Oxides, hydroxides, and peroxides of metals, n.e.s	190	30
Metals, including alloys, all forms	2	110
NONMETALS		
Abrasives, natural	1,055	7
Asbestos	183	(1)
Barite and witherite	23,152	50,150
Cement	19,649	65,752
Clays and clay products:		
Crude clays:		
Bentonite	3,279	2,886
Kaolin (china clay)	3,991	9,223
Other	32,428	41,364
Products:		
Refractory (including nonclay bricks)	1,565	1,815

See footnotes at end of table.

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Table 2.—Spain: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
NONMETALS—Continued			
Clays and clay products—Continued			
Products—Continued			
Nonrefractory		15,425	20,792
Feldspar		930	847
Fertilizer materials, manufactured:			
Ammonia		10,046	8,141
Nitrogenous		20,300	285
Phosphatic		72,350	44,134
Potassic		526,664	668,652
Fluorspar		171,220	139,074
Gypsum and plasters		4,839	4,249
Lime		867	458
Magnesite		10,428	12,646
Meerschaum, amber, jet		8,885	8,294
Pigments, mineral:			
Natural, crude		1,503	536
Iron oxides, processed		18,936	20,218
Pyrite (gross weight)	thousand tons	701	833
Salt	do	301	322
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous		9,811	10,947
Slate		47	7
Worked, all types		27,621	39,648
Dolomite, chiefly refractory grade		12,805	11,054
Quartz and quartzite		32,793	38,814
Sand, excluding metal bearing		25,140	28,456
Sulfur, elemental, all forms		579	493
Other nonmetals, n.e.s.		95	2,100
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets	thousand tons	23	19
Petroleum refinery products:			
Gasoline	do	483	1,205
Kerosine and jet fuel	do	198	386
Distillate fuel oil	do	577	1,834
Residual fuel oil	do	1,089	2,752
Other	do	(1)	85
Mineral tar and other coal, petroleum, or gas-derived crude chemicals	do	13	1,179

[1] Less than ½ unit.

Table 3.—Spain: Principal destinations of selected mineral commodity exports, 1968

(Metric tons unless otherwise specified)

Commodity		Quantity
METALS		
Copper, unwrought [1]		33,974
Netherlands		16,494
West Germany		5,761
Iron ore, total	thousand tons	1,170
West Germany	do	512
United Kingdom	do	479
Roasted pyrite, total	do	770
West Germany	do	608
United Kingdom	do	128
Mercury, total	76-pound flasks	42,975
West Germany	do	11,709
United States	do	10,336
Japan	do	5,284
Czechoslovakia	do	4,258
NONMETALS		
Fertilizer, potassic, manufactured, total		668,652
Poland		128,235
Norway		87,361
United States		73,204
France		62,752
Italy		53,295
Fluorspar, total		139,074
United States		106,462
West Germany		28,850
Pyrite (gross weight), total	thousand tons	833
West Germany	do	542
France	do	104
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products, total	do	6,262
Sweden	do	1,079
United States	do	1,007
Netherlands	do	911
United Kingdom	do	884

[1] Including alloys.

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Table 4.—Spain: Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite and concentrate	64,697	72,741
Oxide and hydroxide	158,772	182,886
Metals, including alloys:		
Scrap	99	8
Unwrought	15,826	16,101
Semimanufactures	10,460	7,187
Antimony:		
Ore and concentrate	65	899
Metal, including alloys, all forms	294	219
Arsenic:		
Trioxide, pentoxide, and acids	739	491
Metal, including alloys, all forms	16	11
Bismuth metal, including alloys, all forms	12	26
Cadmium metal, including alloys, all forms—kilograms	3,403	4,428
Chromite	15,989	29,496
Copper:		
Ore and concentrate	33,805	66,720
Matte	16,510	20,810
Metal, including alloys:		
Scrap	11,178	25,548
Unwrought:		
Blister and other unrefined, unalloyed	19,985	12,294
Refined, unalloyed	24,104	29,024
Semimanufactures	6,466	5,985
Iron and steel:		
Ore and concentrate, except roasted pyrite—thousand tons	598	594
Metal:		
Scrap—do	351	597
Pig iron, ferroalloys, and similar materials—do	22	25
Steel, primary forms:		
Coils for rerolling—do	135	188
Other—do	701	541
Semimanufactures:		
Bars, rods, angles, shapes, sections—do	140	112
Universals, plates and sheets:		
Heavy and medium plates and sheets, uncoated—do	56	45
Light plates and sheets, uncoated—do	83	57
Tinned plates and sheets—do	165	101
Other coated plates and sheets—do	54	20
Hoop and strip—do	20	22
Tubes, pipes, and fittings—do	37	38
Other—do	16	13
Lead:		
Ore and concentrate	-------	11
Metal, including alloys:		
Unwrought, including scrap	464	55
Semimanufactures	642	460
Magnesium metal, including alloys, all forms	350	353
Manganese:		
Ore and concentrates	134,844	184,186
Oxides	558	482
Metal, including alloys	139	107
Molybdenum metal, including alloys, all forms	6	7
Nickel:		
Matte, speiss, and similar materials	245	538
Metal, including alloys:		
Unwrought, including scrap	1,522	1,595
Semimanufactures	1,066	1,467
Platinum-group metals, including alloys—value, thousands	$633	$236
Selenium, elemental—kilograms	5,983	7,337
Silicon, elemental	31	222
Silver metal, including alloys:		
Unwrought and semimanufactures—thousand troy ounces	4,816	3,278
Rolled silver—do	52	229
Tellurium, elemental—kilograms	4,377	1,032
Tin:		
Ore and concentrate—long tons	2,066	2,502
Oxides—do	159	229
Metal, including alloys, all forms—do	72	73
Titanium:		
Ore and concentrate	2,761	23,852
Oxides	5,667	5,477
Tungsten:		
Ore and concentrate	116	28
Metal, including alloys, all forms	6	6
Zinc:		
Ore and concentrate	40,975	54,622
Metal, including alloys:		
Unwrought and semimanufactures	147	65

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Table 4.—Spain: Imports of metals and minerals—Continued
(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS—Continued			
Zinc—Continued			
Metal, including alloys—Continued			
Other		62	219
Zirconium metal, including alloys, all forms	kilograms	1,105	24
Other:			
Ore and concentrate		7,514	4,072
Ash and residues containing nonferrous metals		15,083	18,960
Oxides, hydroxides, and peroxides of metals, n.e.s.		1,428	1,040
Metals, including alloys, all forms:			
Alkali, alkaline earth, and rare-earth metals		18	291
Pyrophoric alloys		7	5
Other base metals, including alloys, all forms		421	348
NONMETALS			
Abrasives, n.e.s.:			
Pumice, emery, natural corundum, etc		1,932	681
Dust and powder of precious and semiprecious stone	value, thousands	$79	$73
Grinding and polishing wheels and stones		797	645
Asbestos		47,936	62,812
Boron materials:			
Crude natural borates		17,080	20,511
Oxide and acid		731	892
Cement	thousand tons	833	804
Chalk		5,055	6,986
Clays and clay products:			
Crude clays, n.e.s.:			
Bentonite		15,473	15,136
Kaolin (china clay)		15,645	5,889
Other		56,389	77,388
Products:			
Refractory (including nonclay bricks)		44,029	11,656
Nonrefractory		22,662	14,080
Cryolite and chiolite		1,170	1,059
Diamond, all grades:			
Gem, not set or strung	value, thousands	$1,619	$2,293
Industrial	do.	$770	$631
Diatomite and other infusorial earths		1,512	8,193
Feldspar		2,054	1,648
Fertilizer materials:			
Crude:			
Nitrogenous	thousand tons	71	60
Phosphatic	do.	1,173	1,260
Manufactured:			
Nitrogenous	do.	213	330
Phosphatic	do.	44	43
Other, including mixed	do.	136	207
Ammonia	do.	4	2
Graphite, natural		773	850
Lime		3,950	3,547
Magnesite		6,420	19,030
Mica, crude, including splittings and waste		696	758
Pigments:			
Natural, crude		127	179
Iron oxides, processed		1,685	1,843
Precious and semiprecious stone, except diamond:			
Natural	value, thousands	$498	$406
Manufactured	do.	$316	$337
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous		14,955	20,408
Slate		1,036	532
Other, including granite, porphyry, sandstone		6,423	7,446
Worked, all types		2,393	2,157
Dolomite, chiefly refractory grade		1,607	1,821
Gravel and crushed rock, including macadam		3,711	12,676
Quartz and quartzite		1,007	680
Sand, excluding metal bearing		53,769	59,499
Sulfur:			
Elemental, all forms		70,610	60,669
Sulfuric acid		26,705	26,725
Talc, steatite, soapstone, and pyrophyllite		2,456	2,729
Other nonmetals, n.e.s.:			
Crude		22,896	64,587
Oxides and hydroxides of magnesium, strontium, and barium		448	696
Bromine, fluorine, and iodine		101	NA
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		2,303	841
Carbon black		16,156	17,591
Coal and briquets:			
Anthracite and bituminous coal	thousand tons	1,338	2,146
Lignite and lignite briquets	do.	86	29

See footnotes at end of table.

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Table 4.—Spain: Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
MINERAL FUELS AND RELATED MATERIALS—Continued			
Coke and semicoke	thousand tons	126	101
Gas, natural	value, thousands	$15,975	$16,511
Hydrogen, helium, and rare gases		235	426
Peat, including peat briquets		2,619	2,666
Petroleum:			
Crude and partly refined	thousand tons	21,217	28,297
Refinery products:			
Gasoline	do	62	101
Kerosine and jet fuel	do	150	190
Distillate fuel oil	do	30	85
Residual fuel oil	do	95	52
Lubricants	do	31	31
Other	do	182	221
Mineral tar and other coal, petroleum, or gas-derived crude chemicals	do	36	29

NA Not available.

Table 5.—Spain: Principal sources of selected mineral commodity imports, 1968

(Metric tons unless otherwise specified)

Commodity		Quantity
METALS		
Aluminum oxide and hydroxide, total		182,886
Guinea		87,860
France		51,378
Guyana		34,596
Copper:		
Ore and concentrate, including matte, total		87,530
Cyprus		23,222
Canada		7,506
Chile		7,157
Italy		5,314
Metal, excluding scrap [1]		47,303
Turkey		7,623
Chile		7,472
Belgium-Luxembourg		7,455
Zambia		6,235
Peru		3,340
Iron and steel:		
Iron ore, total	thousand tons	594
Mauritania	do	229
Morocco	do	233
Scrap, total	do	597
United States	do	242
United Kingdom	do	234
Steel, total [2]	do	1,137
West Germany	do	307
United Kingdom	do	176
Italy	do	105
Bulgaria	do	89
Manganese ore and concentrate, total		184,186
Ghana		37,177
Australia		36,898
Brazil		30,884
Silver, total [3]	thousand troy ounces	3,278
Peru	do	1,198
Mexico	do	537
France	do	461
West Germany	do	343
Tin ore and concentrate, total	long tons	2,502
France	do	573
Congo (Kinshasa)	do	550
Australia	do	514
Zinc ore and concentrate, total		54,622
Sweden		24,198
Canada		10,974
Finland		8,685
NONMETALS		
Asbestos, total		62,812
South Africa		30,545
Canada		29,555
Sulfur, elemental, all forms, total		60,669
France		51,932
MINERAL FUELS AND RELATED MATERIALS		
Coal, anthracite and bituminous, total	thousand tons	2,146
United States	do	1,304

See footnotes at end of table.

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Table 5.—Spain: Principal sources of selected mineral commodity imports, 1968—Continued
(Metric tons unless otherwise specified)

Commodity		Quantity
MINERAL FUELS AND RELATED MATERIALS—Continued		
Coal, anthracite and bituminous—Continued		
West Germany	thousand tons	516
Poland	do	300
Gas, natural, total	value, thousands	$16,511
France	do	$11,358
Petroleum, crude, total	thousand tons	28,297
Saudi Arabia	do	10,005
Libya	do	7,115
Iraq	do	8,511
Refinery products, total	do	681
United States	do	157
Italy	do	142
Netherlands	do	65
France	do	57

[1] Including alloys.
[2] Unwrought and semimanufactures.

COMMODITY REVIEW

METALS

Aluminum.—Spanish production of primary aluminum exceeded 100,000 tons for the first time. Monthly output reached 8,000 tons in May and 10,000 tons in October. While production of individual companies was not available, the rising output was probably due mainly to expanding capacity at plants owned by Empresa Nacional del Aluminio, S.A. (ENDASA). ENDASA capacity was scheduled to increase to 80,000 tons annually by 1971, from 47,000 tons in 1968.

Imports of raw materials increased in 1969, to 94,000 tons of bauxite and 215,000 tons of aluminum oxide and hydroxide. Net imports of unwrought metal rose to 25,000 tons, compared with about 10,000 tons in 1968. Spanish consumption of aluminum appeared to increase by nearly 30 percent.

Copper.—Rio Tinto-Patino, S.A. (RTP) continued work on its $77 million copper mining, smelting, and refining project in 1969. Open pit mining of the Cerro Colorado deposit near Rio Tinto was expected to start in late 1970, while at Huelva, the smelter and refinery were scheduled to be operational by mid-1970.

RTP was building two concentrating plants at Rio Tinto, one for copper ore and the other for gold- and silver-bearing gossan. The copper concentrator will process about 3 million tons of 0.8-percent copper ore annually. The precious metals concentrator, a cyanidation plant using zinc powder for precipitation of metal, will process about 1.5 million tons annually of gossan containing approximately 0.07 ounce gold and 1.3 ounces silver per ton. Reserves were reportedly 39 million tons of copper ore and 18 million tons of gossan. Copper concentrates will be shipped to Huelva for smelting, while gold and silver bullion will be produced at the concentrator.

The new copper smelter at Huelva, which will process foreign as well as domestic concentrates, will have an annual production capacity of 55,000 tons of copper anodes. Capacity of the refinery will be 50,000 tons per year. Each plant may be expanded to an annual capacity of 70,000 tons. A sulfuric acid plant with an output capacity of about 225,000 tons annually was also being built to process smelter gases.

In La Coruña, RTP continued economic investigations of pyrrhotite-chalcopyrite deposits at Arenteiro and Fornás. Preliminary data indicated reserves of 10 million tons of material averaging 0.76 percent copper, minable by open pit.

In the foothills of the Pyrenees, a group of companies including Placer Development Ltd. of Canada was exploring eight sedimentary beds containing copper and lead. The mineralized formations were known to recur over a strike length of 70 miles. Average metal content of samples collected from the concession area was about 1 percent copper and 1 percent lead.

Compañia Española de Minas de Rio Tinto, S.A. (RTE), the major producer of pyrite, reported production of 17,361 tons of blister copper in 1969. The company's smelter was located at Huelva.

Exports of copper totaled less than 18,000 tons in 1969, with crude forms of

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refined metal continuing to account for more than 85 percent of the total. Imports of concentrate and matte were relatively unchanged from the level of 1968, but shipments from the United States fell off sharply. Ireland, Cyprus, Canada, and Italy were the main suppliers of concentrate, while Chile was the principal supplier of matte and blister. Imports of refined copper rose to 36,000 tons, largely obtained from Chile, Zambia, and Belgium.

Iron Ore.—Despite increasing ore requirements of the domestic iron and steel industry, Spain continued to be a net exporter of iron ore in 1969. Exports rose to 1,675,000 tons, 43 percent more than in 1968, while imports rose nearly 65 percent to 978,000 tons. Most exports were destined for West Germany and the United Kingdom, while the principal sources of imports were Brazil, Morocco, and Mauritania. Increased imports were expected in 1970, but the trend in exports was uncertain although shipments to France were expected to rise.

Domestic output of iron ore in 1969 was only 1 percent more than in 1968, but productivity appeared to increase substantially. As of April 1969, there were 71 operating mines, compared with 128 a year earlier; a 20-percent reduction in employment was noted over the same period.

Compañia Andaluza de Minas (CAM) remained the Nation's largest producer and exporter of iron ore. A subsidiary of Compagnie de Mokta of France, CAM operates the Marquesado mine group about 70 miles north of Almería. Iron ore deliveries by the company in 1969 totaled 1,772,273 tons, 13 percent more than in 1968. Sixty-two percent of deliveries went to the home market, and the rest was exported. Deliveries in 1970 were expected to rise to about 2 million tons, including 1.1 million tons to Spanish steel companies and 800,000 tons to France and the United Kingdom.

The Marquesado mine, with proven reserves estimated at 50 million tons, produces ore averaging 57 percent iron, 7.7 percent manganese, and 4 percent silica. Phosphorus and sulfur contents are very low, averaging 0.015 percent and 0.02 percent, respectively. In 1969 the mine had an annual productive capacity of 3 million tons of ore, but in order to utilize this capacity, port facilities at Almería have to be increased. CAM planned to increase loading capacity at the port to 3,000 tons per hour and to provide accommodations for ships of 50,000 deadweight tons. In 1969, loading capacity was only 1,000 tons per hour, and ships of only 18,000 deadweight tons could be handled.

Compañia Minera de Sierra Menera was probably the second largest producer in 1969, with an estimated output of more than 600,000 tons. The company reportedly planned to increase output to 850,000 tons annually by 1972, including about 300,000 tons of pellets.

Late in 1969 the Government authorized construction of a 3-million-ton-per-year pelletizing plant at San Miguel de las Dueñas in northwest Spain. A 50-percent share in the venture will be held by Instituto Nacional de Industria (INI), with minority participation by the Coto Wagner and Coto Vivaldi groups. Estimated cost of the plant was $46 million.

Iron ores of León and Lugo Provinces of northwest Spain, of which those mined by the Wagner and Vivaldi groups are typical, include a minimum proved reserve of 100 million tons and are relatively rich in phosphorous as well as in magnetite. Beneficiation research at the National Center for Metallurgical Research in Madrid indicated that magnetic concentration of Wagner and Vivaldi ore can yield a product containing 62 to 63 percent iron and 0.39 to 0.50 percent phosphorous, with a recovery of 62 to 64 weight-percent. By treating the concentrate with sulfuric acid, phosphorus content could be reduced to approximately 0.06 percent, with an acid consumption of about 30 kilograms per ton.

Research was also being conducted on the extraction of copper from magnetite ores in Cala (southwest Spain) and of lead from iron ores in the northwest. Both metals occur in the ore as sulfides.

Recovery of magnetite from processing of lead-zinc ores at Cartagena was expected to resume by 1972, at the Roberto concentrator of Sociedad Minero y Metalúrgica de Peñarroya-España, S.A. Production of 20,000 tons of magnetite annually was projected from 1972–75. Recovery during previous operations (1959–67) had amounted to 170,000 tons.

Iron and Steel.—Output of iron and steel continued to increase, but even with the gain of 18 percent in metal production compared with 1968, imports rose by more than 60 percent owing to unexpectedly

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heavy domestic demand. Domestic consumption rose by 24 percent to approximately 8.4 million tons and was expected to rise to 9.3 million tons in 1970. With rising world prices for raw materials and increasing costs of production in Spain, Government controls on steel prices were difficult to maintain and prices for some finished products rose much higher in 1969 than the authorized increases of 5 to 7 percent. However, Spanish prices remained below world levels, and there was no significant improvement in the cost-price squeeze experienced by the industry since devaluation of the peseta in 1967.

Investment in the industry remained high, and production capacity for iron, steel, and rolled products continued to increase. Investment was estimated at $220 million in 1969, and during the year, annual production capacity increased by about 1.5 million tons for oxygen-blown Linz-Donawitz (LD) steel and by half a million tons each for pig iron and hot-rolled products. Five electric steel furnaces also began operating. New capacity for 2 million tons of crude steel and 1.5 million tons of hot-rolled strip was expected to be available in 1971.

Spanish production of iron and steel continued to be dominated by three firms: the state-owned Empresa Nacional Siderúrgica, S.A. (ENSIDESA), and the private firms of Altos Hornos de Vizcaya, S.A. (AHV) and Unión Siderúrgicas Españolas, S.A. (UNINSA). Production by these companies in 1969 was reported as follows, in thousand metric tons:

	AHV	ENSIDESA	UNINSA
Pig iron	1,230	1,432	512
Crude steel	1,190	1,726	575
Rolled products	1,310	• 1,600	NA

• Estimate. NA Not available.

Imports of iron and steel items exceeded 3 million tons in 1969, while exports totaled about 275,000 tons. Major imported items were scrap (1,237,000 tons), crude forms (927,000 tons), sheets and plates (550,000 tons), and special steel products (95,000 tons). Imports were expected to remain high in 1970.

The Government decided to go ahead with construction of a major new iron and steel works at Sagunto. The project was being studied by a special commission which included representatives of INI, the Ministry of Industry, and the principal steel producers. The Government will reportedly offer 51 percent of the capital stock to Spanish investors and 49 percent to foreign firms, with the Government absorbing that portion of the total required investment not taken by domestic or foreign interests. The recommended level of production capacity and investment was not known, but it was expected to be less than the 10-million-ton $3 billion project reportedly proposed in 1968.

Pig Iron.—A fourth blast furnace was commissioned in 1969 at the Avilés works of ENSIDESA. The furnace has a hearth diameter of about 28 feet and a production capacity of about 500,000 tons of pig iron per year. Meanwhile, AHV dismantled four old blast furnaces in 1969, two at Baracaldo and two at Sestao; these units were apparently replaced by a new furnace with an output capacity of 3,000 tons of pig iron daily. At Veriña, near Gijon, the first blast furnace of the new UNINSA works was almost completed, and a second was under construction; output capacity of each unit was expected to be about 3,000 tons of pig iron daily. At yearend, annual production capacity for pig iron by the three major producers was estimated at 4.3 million tons, of which ENSIDESA had 45 percent, AHV 40 percent, and UNINSA 15 percent.

Steel.—In 1969, three more LD converters were completed, and several more were under construction. ENSIDESA completed two 100-ton units and a continuous casting machine at Avilés, raising output capacity by 1 million tons to 2.5 million tons annually. AHV completed a third 70-ton converter at Sestao which, together with two 36-ton units recently completed at Sagunto, raised the company's steelmaking capacity to 2 million tons annually. UNINSA was installing two 130-ton converters at Veriña, where the company hoped to develop an annual output capacity of 2.1 million tons of steel by 1972. Production of LD steel in 1969 included 1,044,000 tons by ENSIDESA and 864,000 tons by AHV; compared with 1968, these outputs represented increases of 49 and 43 percent, respectively.

Other facilities under construction at the Laminación-Este works by ENSIDESA (with annual capacities in parentheses) included a hot-strip mill (1.5 million tons), pickling line (500,000 tons), shearing line (210,000 tons), galvanizing line (65,000

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tons), and electrolytic tinning line (135,000 tons); all facilities were scheduled for completion in 1971. AHV was also installing a blooming and slabbing mill at Sestao, with a capacity of 1.5 million tons annually.

Lead, Zinc, and Associated Metals.—Increasing productive capacity and domestic demand for lead, zinc, and associated metals was reflected in Spanish statistics of production and trade in 1969.

Although mine output of lead was 6 percent less than in 1968, partly owing to a drop in production of concentrates at Cartagena, output of metal by smelters of Sociedad Minero y Metalúrgica de Peñarroya-España, S.A. increased nearly 30 percent, possibly from utilization of ore stocks carried over from 1968. Peñarroya's output of metal in 1969 included 54,500 tons of lead and more than 2 million ounces of silver. Trade in lead remained negligible; exports increased but were still less than 1 percent of domestic production.

An increase of about 7 percent in mine and refinery output of zinc in 1969 was accompanied by a 75-percent reduction in imports of concentrate and a 69-percent drop in exports of metal. Exports of concentrate and zinc-bearing ashes and residues, however, climbed to 11,662 tons and 22,194 tons, respectively, with most going to West Germany and France. Real Compañia Asturiana de Minas (Cie. Royale Asturienne des Mines (CRA)) remained the major producer of zinc, most of which was mined at Reocín and smelted at Avilés. Annual output capacity of the electrolysis plant at Avilés, operated by Sociedad Asturiana del Zinc, was 65,000 tons of zinc at yearend 1969 and was to be increased to 75,000 tons. At Cartagena, productive capacity of Española del Cinc, S.A. was raised to 30,000 tons of electrolytic zinc annually, and an additional 10,000 tons of capacity was planned. The latter company produced 23,500 tons of zinc in 1969.

Expansion and modernization of the Santa Lucía lead smelter and refinery at Cartagena was nearly completed by the Peñarroya firm in 1969. The plant will have an annual processing capacity of about 100,000 tons of lead concentrate, and annual output capacities of 65,000 tons of lead bullion and 75,000 tons of refined lead. Byproducts will include silver (997 fine), antimony (regulus), copper, and oxides of arsenic and zinc. When the Santa Lucía Plant is completed in mid-1970, the company will close the Penárroya-Pueblonuevo smelter in Córdoba.

Output of lead and zinc concentrates from Peñarroya's Roberto mill in Cartagena was 22,473 tons and 31,370 tons, respectively, in 1969. Silver content of the lead concentrate was approximately 25 ounces per ton. During the year, the Roberto mill processed 1,759,000 tons of crude ore averaging 1.72 percent lead, 1.33 percent zinc, and about 0.4 ounce silver per ton. The number of open pit mines supplying the mill was increased to five in 1969. Ore reserves at these properties were estimated to total 27 million tons, with a recoverable metal content of 273,000 tons of lead and 215,000 tons of zinc. Ten million tons of possible ore in underground mines, as yet unevaluated, may increase the figures for recoverable metal by 30 to 35 percent.

In the Linares-La Carolina district of Jaén, lead reserves at Linares properties of Empresa Nacional "Adaro" de Investigaciones Mineras, S.A., (ENADIMSA) a member of the state-owned INI group, were estimated at 45,000 tons. This was sufficient for 9 years at the company's current rate of production. As of mid-1969, ENADIMSA operations had produced 51,000 tons of mine lead. The company continued exploration of "promising" deposits of lead and zinc around Linares, and of deposits in Almería and northern Huelva.

In the La Carolina area, Compañia Minero y Metalúrgica Los Guindos, S.A. was reported to have discovered a rich vein deposit of lead. The discovery appeared to be a hitherto-unknown 1,000-meter extension of the vein system now worked by the Los Guindos mine. While metal content was not reported, the lead ores of this district are usually relatively rich, easy to concentrate, and contain appreciable quantities of silver. The Los Guindos company, an important Spanish producer of silver and lead, operated a smelter at Málaga with an annual processing capacity of at least 56,000 tons of lead concentrates.

In other activities, a large area containing lead and copper was being explored south of the Pyrenees (see section on Copper). Investigations of lead and zinc deposits in many other parts of the country were being carried out by the Spanish Geological and Mining Institute, other

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Government agencies, and private companies in 1969.

Mercury.—Production of mercury ore was close to the relatively high levels of 1968, but the overall grade was considerably higher and resulted in a 33-percent increase in mine output of metal. Average mercury content of cinnabar ore (mostly mined at Almadén) rose to 2.6 percent, compared with 1.9 percent in 1968, while the average grade of arsenical ores mined in Asturias declined to slightly less than 0.2 percent Hg (0.22 percent in 1968).

Reported production of metal was about 8,000 flasks less than might be expected from the quantity mined, suggesting an increase in ore stocks. An increase in stocks of metal was also suggested, as production exceeded exports by more than 22,000 flasks. Exports in 1969 were about 2 percent less than in 1968 and 17 percent less than in 1967. Compared with 1968, reported shipments to the United Kingdom increased nearly fivefold while those to West Germany, the principal buyer, rose by 18 percent. Shipments to East Europe also increased by 40 percent, while exports to the United States and Japan were less than 30 percent of 1968 totals.

Despite the decline in exports and falling world prices, Minas de Almadén reportedly planned to increase output of mercury to about 3,000 metric tons (87,000 flasks) annually by 1972. The company was improving recovery systems at its metallurgical plant (four rotary Pacific furnaces, each with a daily processing capacity of 100 tons of ore) and was intensifying exploratory work in its concession area, where five drilling programs are projected. The Almadén concession area (485,000 acres) includes parts of the provinces of Ciudad Real, Córdoba, and Badajoz.

Arsenical mercury ores mined at La Peña (Mieres), south of Oviedo, were the second most important Spanish resource of mercury, providing about 105,000 tons of ore in 1969 and 80 percent of the mercury mined in Asturias. Producing companies were Minas de Soterraña, S.A. and Sociedad Astur Belga de Minas, S.A. The former company also mined arsenical ore at Pola de Lena, about 10 miles south of Mieres. The ore at La Peña has a lower content of mercury, but arsenic is also less abundant and the ore is easier to process. Arsenic occurs mainly as arsenopyrite at La Peña, and as realgar at Pola de Lena. Average contents of mercury, arsenic, and sulfur in ore from these localities was reported in 1969 as follows:

Locality	Percent		
	Mercury (Hg)	Arsenic (As)	Sulfur (S)
Pola de Lena	0.48–0.80	0.5–1.2	0.7–1.1
La Peña	.2–.5	.1–.5	.6–1.9

Source: Viña, R. A. "Estudio de nuevas tecnicas para el tratamiento metalúrgico de los minerales asturianos de mercurio." (Study of New Methods for Metallurgical Treatment of Asturian Mercury Ores). "Facultad de Ciencias", v. 10, No. 1; Oviedo, 1969, 133 pp.

Titanium.—Both production and imports of ilmenite declined in 1969. Imports dropped to 17,000 tons but were still well above the level of 1967. Ilmenite is mined in the northwest province of La Coruña.

Dow-Unquinesa, S.A., the sole Spanish producer of titanium dioxide, was increasing production capacity at Axte-Bilbao. Capacity of the company's sulfate-process plant was expanded to 14,000 tons annually in 1969, and a further expansion to 20,000 tons capacity was scheduled for competion in 1970.

NONMETALS

Celestite.—Although not reported by official Spanish statistics, production and exports of celestite were increasing. The main stimulus appeared to be rapidly growing demand for strontium compounds by producers of color-television sets and ferrite magnets, especially in the United States. While U.S. imports of strontium minerals continue to be obtained principally from the United Kingdom and Mexico, imports of Spanish celestite have increased, as shown by the following tabulation, in metric tons:

Year	Source country		
	United Kingdom	Mexico	Spain
1967	2,217	2,856	------
1968	4,134	3,519	4,031
1969	3,764	19,415	2,043

Sources: (1) U.S. Department of Commerce. U.S. Imports for Consumption, 1964–69. (2) Industrial Minerals (London), No. 27, December 1969.

The celestite is mined at Montevive, several miles southwest of Granada in southern Spain. The Montevive deposits reportedly contain 25 million tons of celestite-bearing material. Proved reserves include 2 million tons of commercial-grade

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celestite, minable by open pit methods, and possible additional reserves of 6 million tons. Mechanized mining on a full-time basis began at the existing quarry in 1969, and a second quarry was being prepared for production in 1970. The mine product is hand-sorted and crushed, and is guaranteed to contain 92 percent $SrSO_4$. The shipping port is Motril, about 50 miles to the south.

Celestite was reportedly discovered at several localities in the vicinity of Vic, near Barcelona, but no information was available concerning economic potential of these deposits.

Cement.—Output and productive capacity of the Spanish cement industry continued to grow in 1969. Production averaged 88 percent of total plant capacity and was sufficient to meet more than 99 percent of domestic demand. Total consumption in 1969 was estimated at 16.12 million tons.

About 1 million tons of annual productive capacity was added in 1969, and another 3.8 million tons was planned for installation by 1972.

Output of manufactured cement in 1969, by type and percentage of total output, was portland (93.3), slag (2.5), white (2.0), pozzolanic (1.0), aluminous (0.4), and others (0.8).

Wholesale prices for portland cement averaged about $13.25 per metric ton, slightly less than the average for the previous 5 years. About 35 percent of all cement was delivered in bulk; the rest was in bags.

Diamond.—Diamonds of industrial quality were discovered southwest of Málaga. The stones, up to three-quarters of a carat in size, were found in Kimberlite during explorations for nickel in basic rocks north of Marbella. The prospecting group, including Canadian, Belgian, and Spanish Government companies, planned to build a pilot washing plant to test the economic potential of the deposits.

Fertilizer Materials.—*Phosphate.*—Development of the large phosphate deposits at Bu-Craa in the Spanish Sahara was continued in 1969, through Fosfatos du Bu-Craa, S.A. of Madrid, a company of the INI group. A contract was signed with Klöckner-Humboldt-Deutz A.G. of West Germany, for construction of a preparation plant designed to produce 3.3 million tons of concentrate annually from 5 million tons of crude ore. Part of the output will be consumed in phosphoric acid, and fertilizer plants at Huelva operated by Fosfórica Española (a subsidiary of Unión Española de Explosivos, S.A. (UEE) and Cros, S.A.) and Interquímica, S.A., using sulfuric acid supplied mainly by RTE and Interquímica.

RTE and UEE decided to merge in 1969. This move will consolidate under one management a significant part of Spain's production capacity for pyrite, potash, sulfuric and phosphoric acids, and manufactured fertilizers. Formal constitution of the new firm, Unión Explosívos Rio Tinto, S.A. (UERT), was expected in 1970.

Imports of crude phosphate rose to 1,343,000 tons in 1969. Principal suppliers were Morocco (73 percent) and the United States (22 percent).

Potash.—Output of potash continued to rise, although exports fell nearly 20 percent below the 1968 level. Poland and Norway remained the principal buyers, but shipments to the United States were drastically reduced and declines of 30,000 to 40,000 tons were recorded for France, Italy, and the Republic of South Africa.

Under the Second Development Plan, production of potash is slated to rise to 925,000 tons in 1971. Most of the increase was expected to come from the Pamplona district, where the State-controlled company, Potasas de Navarra, was doubling productive capacity. Concentrators under construction included a silvinite plant with processing capacity of 6,000 tons daily and a carnallite plant with processing capacity of 8,000 tons daily.

In Barcelona, UEE was increasing output capacity of the Cardona mine and plant. Shaft haulage from the 1,020-meter level of the mine will be replaced by a 4,100-meter conveyor system by 1972. Two concentrators, with a total processing capacity of 3,500 tons daily, were in operation in 1969, and a third, with daily capacity of 5,000 tons, was planned.

Fluorspar.—Although output of fluorspar in 1969 was virtually unchanged from 1968, exports increased by 45 percent to nearly 202,000 tons. Exports to the United States and West Germany were 155,000 tons and 34,000 tons, respectively. The major producer, Minerales y Productos Derivados, S.A. (Minersa), increased output of wet filter cake about 3 percent, to 110,000 tons, of which 83 percent was exported to the United States and about 9

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percent was sold on the home market. CRA recovered 8,886 tons of fluorspar (8,116 in 1968) from processing lead-zinc ores at Irun in Guipúzcoa.

Domestic consumption of fluorspar for production of basic inorganic chemicals was 56,227 tons in 1968, a 32-percent increase compared with 1967 production.

Pyrite and Sulfur.—Spanish production, exports, and consumption of pyrite continued to rise in 1969. Although total output rose only 3 percent compared with 1968, exports increased by 23 percent and deliveries to the home market increased by an estimated 10 percent. Exports of pyrite rose to 1,024,000 tons, while shipments of calcines dropped to 668,000 tons. West Germany—particularly the firm of Duisburger Kupferhütte A.G.—remained the principal buyer.

The official export price was unchanged from the 1968 level (approximately $11.16 per metric ton of RTE crude fines containing 48 percent sulfur, f.o.b. Huelva), but actual prices were reportedly 5 to 8 percent less. Effective January 1, 1970, the export price was reduced to the equivalent of $9.84. The official domestic price remained substantially lower, although it was raised to $7.56 from $7.17 on March 1, 1969.

Pyrite production in Huelva by RTE and Compañia de Azufre y Cobre de Tharsis continued to account for most of the national output. Deliveries by RTE rose to 1,217,000 tons, while sales by the Tharsis Co. again increased, to 1,081,000 tons. Both companies were expanding productive capacity. RTE was deepening the Atalaya open pit, and completed a new crushing and ore preparation plant with an annual output capacity of 1.2 million tons of pyrite in 1969. The plant capacity can be increased to 1.8 million tons if necessary. The Tharsis Co. continued preparations to mine the Sierra Bullones, San Guillermo, and North Lode deposits from one open pit. Underground mining at Sierra Bullones was scheduled to cease by the fall of 1970. The company continued underground mining at the La Zarza deposit, 15 miles to the northeast, where the use of trackless loaders and new crushing and hoisting equipment has boosted production by at least 25 percent. During the last 5 years, the Tharsis Co. reportedly doubled output capacity while reducing employment by 50 percent. Combined productive capacity of RTE and Tharsis was expected to be at least 3.2 million tons annually by 1972.

Domestic consumption of pyrite for manufacture of sulfuric acid and other basic inorganic chemicals (1.56 million tons in 1968) probably exceeded 1.6 million tons in 1969. Output of sulfuric acid, which is based 90 to 95 percent on pyrite, rose about 4 percent to 2.09 million tons. A sharp increase in consumption of pyrite was expected by 1972, as several large pyrite-based sulfuric acid plants (totaling 1 million tons of new productive capacity) were under construction and planned in 1969. Plants (with companies and annual capacities in parentheses) under construction were at Huelva (RTE, 342,000 tons) and Axpe-Bilbao (Dow-Unquinesa, 47,000 tons), while others were scheduled to be built at Huelva (Interquímica, 396,000 tons) and near Barcelona (Barrau S.A., 180,000 tons).

New sulfuric acid plants based on smelter gases included a 50,000-ton unit at Cartagena, completed in 1969 by Española del Cinc, and a 225,000-ton unit under construction at Huelva by RTP.

With large quantities of pyrite available on the domestic market at low prices, Spanish demand for crude sulfur is relatively small. Average annual requirements are 60,000 to 70,000 tons, mostly supplied by imports which are augmented by a small domestic output (8,000 tons in 1968) recovered from smelter gas, lignite, and oil. Although domestic production reportedly declined to 3,000 tons in 1969 and imports rose to 74,000 tons, recovery of sulfur at petroleum refineries was expected to increase substantially. A 15,000-ton recovery unit was commissioned at Algeciras in 1969, and a 14,000-ton unit was scheduled for completion at Bilbao in 1971.

MINERAL FUELS

Coal, Lignite and Coke.—As of April 1969, the number of mines and total mine employment in the solid fuel industry was reduced to 202 mines and 65,920 employees, compared with 250 mines and 68,390 employees in April 1968. Seventy-five percent of the output of the Asturian coal basin was controlled by the State firm, Hulleras del Norte, S.A. (HUNOSA).

Due to increasing demand from the iron and steel industry and electric powerplants, and the decline in domestic coal produc-

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tion, imports of bituminous coal in 1969 increased to more than 2.44 million tons, 13 percent more than in 1968. The United States supplied 1,735,000 tons, or 71 percent.[3] The remaining tonnage was supplied by Poland and West Germany. In addition, 33,000 tons of anthracite was imported from the Republic of South Africa. Domestic consumption of coal and lignite was 14.3 million tons in 1969.

Spanish consumption of coal by sector, in thousand metric tons, is shown by the following tabulation:

Consuming sector	1967	1968
Thermal powerplants	r3,296	4,628
Coking plants	r4,200	4,752
Railways	r200	24
Iron and steel industry	550	400
Patent fuel plants	r330	133
Gas works	80	33
Other industry	3,945	3,215
Other	r900	625
Total	13,501	13,810

r Revised.
Source: Organization for Economic Cooperation and Development (OECD) (Paris). Statistics of Energy, 1954–1968. 1970, pp. 262–265.

The two major steelmaking companies continued to account for most of the output of metallurgical coke. Production in 1969 by ENSIDESA and AHV was 1,276,000 tons and 981,000 tons, respectively.

Natural Gas.—In July 1969, Gas Natural, S.A. inaugurated in Barcelona its regasification plant for liquefied natural gas to be furnished by Esso Standard Libya, Inc. At yearend, however, the imports of gas had not yet begun, as the Libyan Government suspended deliveries pending an agreement on the price of the gas.

Natural gas was discovered in northern Spain near Urbasa, in the province of Alava. The gas-bearing formation was struck at a depth of 7,150 feet and extended to a depth of at least 8,650 feet.[4]

Nuclear Energy.—The firm Nuclenor stated that its 460-megawatt boiling-water-type nuclear power station at Santa Maria de la Garona, at present under construction by General Electric Co., would start to generate electric power in the summer of 1970.

Petroleum. — *Exploration.* — Exploration activities decreased markedly in Spain during 1969. Only seven wells were spudded during 1969, compared with 16 in 1968. Seismic exploration was also decreased. Most efforts were concentrated in the Cantabrian and South Pyrenean basin.[5]

Since 1956, Spanish and other companies have spent over $160 million on oil exploration, but only American Overseas Oil Co. (AMOSEAS) and Compañia Arrendataria Del Monopolio de Petróleos, S.A. (CAMPSA) have found commercial oil to date. Commercial production began in early 1967 from the Ayoluengo field, in Burgos Province, where reserves are estimated at 1.6 million tons. Production averages 4,000 to 4,500 barrels per day at 37° API crude, yielding 25 to 30 percent gasoline.[6]

Refining.—Spanish imports of crude petroleum, which increased sharply during 1965–68 because of the rapid growth of the domestic refining industry, have become somewhat stabilized. Imports in 1969 totaled 29.8 million tons, up 5.4 percent from 1968. The total cost of foreign crude, excluding freight, amounted to $390 million. The imports also accounted for a reported $40 million in business for foreign shipping companies. In 1969, 54 percent of Spanish crude oil imports came from the Middle East, 36 percent from Libya, 4 percent from Venezuela, and the rest from Nigeria, Algeria, and the Soviet Union. Exports of refined products were valued at $110 million in 1969.

Expansion of the Coruña refinery belonging to Petroliber-Compañia Iberica Refinadera de Petróleos, S.A. was completed. It consists mainly of a 44,000-barrel-per-day distillation unit and a 105,000-barrel-per-day unifying-platforming unit.[7] A 6-million-ton-per-year oil refinery is planned near Tarragona, to go on stream in 1975. Bids for building the refinery will be called later in the year according to Spain's Ministry of Industry.

Production of refinery products was up 7.8 percent to almost 28.4 million tons during 1969.

[3] National Coal Association. Foreign News Notes. No. 270. June 25, 1970, p. 2.
[4] Bulletin de l'Industrie Pétrolière. Nos. 1490 and 1517, Dec. 23, 1969, and Feb. 4, 1970.
[5] Bulletin. American Association of Petroleum Geologists (AAPG). V. 54, No. 8, August 1970, p. 1444.
[6] World Petroleum Report 1970. V. 16, pp. 125–126.
[7] Bulletin de l'Industrie Pétrolière. No. 1585, May 15, 1970.

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Consumption of liquid fuels and of fuel oils by consuming sector, in 1967 and 1968, is shown in the following tabulations, in thousand metric tons:

	1967	1968
Fuel:		
Gasoline	1,828	2,161
Kerosine	250	218
Jet fuel	r 371	546
Fuel oils	11,490	13,781
Liquefied petroleum gas	892	1,024
Refinery fuel	r 1,000	1,250
Total	15,831	18,980
Fuel oils, by sector:		
Thermal powerplants	2,147	2,602
Gas works	210	300
Transportation:		
Highway	3,007	3,614
Railroad	898	1,010
Inland waterways	931	2,165
Industry	3,472	3,050
Others	825	1,040
Total	11,490	13,781

r Revised.
Source: Organization for Economic Cooperation and Development (OECD) (Paris). Statistics of Energy 1954–1968. 1970, pp. 262–265.

Inland consumption of all finished petroleum products increased by 13.4 percent in 1969, to 21.1 million tons.

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The Mineral Industry of Sweden

By J. B. Huvos,[1] F. L. Klinger,[2] and Bernadette Michalski [1]

Sweden's output of minerals, metals, and petroleum products continued to grow in 1969. Mine output of copper, lead, and zinc was substantially higher than in 1968. The massive production of iron ore, Sweden's principal mineral export and a mainstay of supply for West Europe's steel industry, set a new record high despite a strike that idled the mines at Kiruna in December. Production of tungsten and fluorspar at the Yxsjöberg mine was expected to resume in 1971; the possibility of producing vanadium from titaniferous magnetite at Taberg was being investigated.

Smelter capacities for aluminum and copper were increased, and several new plants for recovering sulfur from sulfide ores were under construction. Production and consumption of steel were at record high levels, and the ratio of alloy and high-carbon steels to total steel output (27 percent in 1969) remained the world's highest. Increasing efficiency of mine and plant operations, and innovations in metallurgical practice, continued to raise productivity and to improve the competitve position of Swedish materials and technology.

AB Svenska Metallverken, the only Swedish producer of aluminum and the major processor of nonferrous metals, was acquired in 1969 by the Grängesberg iron and steel concern. Important cooperative agreements were also made by the Grängesberg Co. with other large producers of steel, such as AB Svenska Kullagerfabriken (SKF) and Stora Kopparberg Bergslags AB (SKB). Reorganization and expansion of production facilities for pyrite, sulfur compounds, and fertilizers was continued by Boliden Aktiebolag.

In the energy sector, Oljeprospektering AB (a Swedish consortium of Government and private companies) was formally constituted and began prospecting for oil and gas. The Oljekonsumenterna (OK) cooperative announced plans to build a 4-million-ton petroleum refinery near Göteborg. Delays were encountered in completion of Sweden's first large nuclear powerplant at Marviken, but 11 other plants were under construction or planned in 1969. The Government continued efforts to economically exploit the large but low-grade deposits of uranium at Ranstad.

PRODUCTION

Preliminary volume indices of production for different sectors of the Swedish mineral industry in 1969 and final indices for 1968 were as follows:

Industry sector	(1959 = 100)	
	1968	1969
Iron ore mining	r 187	190
All mining and quarrying	r 174	178
Primary metals	r 196	212
Nonmetallic mineral manufacturing	r 185	191
Products of coal and petroleum •	320	350
All industry	r 179	194

• Estimate. r Revised.

Source: Central Bureau of Statistics (SCB), Stockholm. Statistiska Meddelanden. I, 1970: 29; p. 1 (8), July 17, 1970.

The indices primarily reflect increased output in 1969 of iron and copper ores; steel, aluminum and copper; and petroleum refinery products. Output of copper ore increased about 2 million tons because the Aitik mine had a full year's production. An estimated 1.5 million-ton loss in iron ore production resulted from the Luossavaara-Kiirunavaara AB (LKAB) strike in December. The published indices for nonmetallic mineral manufacturing in 1969 seem not to be borne out by avail-

[1] Foreign mineral specialist, Bureau of Mines, Washington, D.C.

[2] Physical scientist, Bureau of Mines, Washington, D.C.

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able production statistics, although the figures are tentative. The increase in petroleum processing was leveling off, as most new refinery capacity was completed in 1968, but the petrochemicals industry continued to expand.

Table 1.—Sweden: Production of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Aluminum, primary [2]	33,441	55,800	66,800
Arsenic, white	20,200	21,100	16,500
Bismuth	•30	NA	NA
Cobalt, metal	3	•3	NA
Copper:			
Mine output, metal content	15,285	18,200	25,200
Matte	1,572	200	1,800
Cement	731	400	------
Refined:			
Electrolytic	47,691	46,700	51,800
Of which derived from scrap	15,493	18,824	18,702
Gold:			
Mine output, metal content, troy ounces	60,668	49,737	42,310
Metal, including alloys, do	117,446	106,097	118,957
Iron and steel:			
Iron ore and concentrate:			
Ore, direct shipping, thousand tons	22,450	26,632	26,883
Concentrates, do	5,887	5,788	6,302
Total, do	28,337	32,420	33,185
Roasted pyrite, do	264	193	NA
Pig iron, do	2,362	2,495	2,529
Sponge iron, do	152	152	179
Ferroalloys, do	209	230	247
Steel:			
Ingots, do	4,483	4,456	4,612
Billets, do	286	583	647
Castings	49	56	67
Total crude steel, do	4,768	5,095	5,326
Alloy and high-carbon steel, do	1,141	r1,304	1,454
Steel semimanufactures:			
Bars, rods, sections, do	1,548	r1,630	1,678
Plates and sheets, do	1,008	r1,078	1,150
Strip, do	494	529	610
Rails and accessories, do	43	38	51
Seamless tube, do	204	218	236
Other, do	143	r142	127
Total semimanufactures, do	3,440	r3,635	3,852
Lead:			
Mine output, metal content	73,600	72,000	80,000
Metal, refined [2]	42,000	41,900	42,100
Manganese ore (13 to 15 percent Mn)	18,814	11,700	8,800
Selenium, elemental	60	•r85	•90
Silicon, elemental	8,922	8,200	9,700
Silver:			
Mine output, metal content, thousand troy ounces	3,455	3,524	3,683
Metal, including alloys, do	4,173	4,688	6,858
Titanium metal	45	NA	NA
Uranium oxide (U_3O_8) •	63	70	70
Zinc:			
Mine output, metal content	81,821	81,300	90,100
Clinker (70 to 75 percent Zn)	29,600	29,500	29,500
Other:			
Ores and concentrates, value, thousands	$164	NA	NA
Ashes and residues containing nonferrous metals	r14,800	r14,900	13,100
NONMETALS			
Cement, hydraulic (excluding clinker), thousand tons	r3,902	3,912	3,958
Chalk	17,890	16,800	18,500
Clays:			
Fire clay	191,221	69,400	44,500
Kaolin:			
Crude	29,055	27,600	23,900
Washed	71	100	4,800
Other (klinkerlera)	------	42,900	49,700
Diatomite:			
Crude	3,752	•3,000	•3,000
Calcined	517	500	600
Feldspar	r35,572	27,300	33,300

See footnotes at end of table.

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Table 1.—Sweden: Production of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
NONMETALS—Continued				
Fertilizer materials, manufactured:				
Nitrogenous	thousand tons	271	298	NA
Phosphatic:				
Thomas slag, gross weight	do.	67	74	NA
Other	do.	380	414	NA
Other, including mixed	do.	787	792	NA
Graphite, all grades		45	NA	NA
Lime (quicklime and hydrated lime)	thousand tons	921	r 810	810
Pigments, natural mineral		1,404	1,200	1,200
Pyrite and pyrrhotite (including cupreous):				
Gross weight		482,500	474,400	495,200
Sulfur content		246,000	r 250,500	266,200
Quartz and quartzite:				
In blocks	thousand tons	65	72	80
Other	do.	1,225	1,273	1,268
Stone and gravel, not elsewhere specified:				
Dimension stone:				
Unworked:				
Limestone and marble	thousand tons	120	• 110	NA
Granite and gneiss	do.	143	• 150	NA
Other, including slate	do.	176	• 95	NA
Worked, all types	do.	211	197	190
Crushed, ground and other:				
Dolomite:				
Crude	do.	263	283	291
Burnt	do.	58	51	45
Limestone and other calcareous:				
For cement, lime, and flux	do.	9,772	10,391	8,923
Other	do.	417	402	454
Granite and gneiss	do.	7,862	5,646	4,825
Other	do.	900	872	680
Sulfur:				
Elemental (recovered from oil shale)		2,101	------	------
Sulfuric acid (100 percent) and oleum		603,394	632,015	648,000
Talc and steatite		r 25,139	23,700	28,400
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades	thousand tons	11	20	22
Coke: [2]				
Coke oven	do.	508	523	• 530
Gas	do.	499	493	• 485
Peat:				
For agricultural use •	do.	115	100	NA
For fuel use	do.	25	• 25	NA
Petroleum:				
Oil shale:				
For fuel	do.	307	NA	NA
For other use	do.	420	448	246
Refinery products: [4]				
Gasoline	do.	799	1,180	1,254
Kerosine, jet fuel, white spirit	do.	109	32	207
Distillate fuel oil	do.	1,481	1,989	2,791
Residual fuel oil	do.	2,630	4,461	4,983
Liquefied petroleum gases	do.	60	1,298	NA
Lubricants	do.	78		69
Other	do.	740		1,000
Total	do.	5,897	8,955	10,304

• Estimate. r Revised. NA Not available.

[1] According to information available August 1970.

[2] Figure includes small quantities of metal derived from scrap; up to 1 percent for aluminum and up to 2 percent for lead.

[3] Source: Organization for Economic Cooperation and Development (OECD) (Paris). Statistics of Energy, 1954–68, pp. 226–229.

[4] Source: Organization for Economic Cooperation and Development (OECD) (Paris). Oil Statistics—Supply and Disposal (1967–68).

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TRADE

Mineral commodity trade constituted about 20 percent of Sweden's total trade, or $2,400 million in 1969. The unfavorable mineral trade balance created a $408 million deficit in 1969, compared with $376 million and $333 million deficits in the previous 2 years. During 1969 mineral commodity exports were valued at $1,002 million, increasing by 10.6 percent over 1968. The major growth was recorded in the metal industry. In value, iron ore exports increased by 10 percent to $238 million, and exports of iron and steel rose to $510 million, compared with $443 million in 1968. Exports of nonferrous ores and concentrate increased by 14 percent, to more than $20 million. Most nonferrous metals registered sizeable increases; however, exports of copper (valued at $108 million) and aluminum (valued at $29 million) reflected the largest gains over 1968. Petroleum product exports declined by more than 15 percent to $48 million from the 1968 level of $58 million.

The value of mineral commodity imports increased by 9 percent over 1968 to $1,410 million. About 39 percent of this value was attributable to crude petroleum and petroleum products, the latter registering a small decline in 1969. The value of steel imports increased by 38 percent, to nearly $327 million in 1969. Steel imports exceeded exports for the first time since 1966, but the high proportion of quality steels in Swedish exports resulted in an export surplus of about $20 million.

The bulk of Swedish trade was conducted with the European Free Trade Association (EFTA) and the European Economic Community (EEC). Mineral commodity exports to these areas were valued at $468 million and $439 million, respectively, in 1969; the corresponding values for imports were $477 million and $471 million.

Table 2.—Sweden: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum, metal, including alloys:			
Scrap		1,451	968
Unwrought		8,887	16,103
Semimanufactures		18,630	18,452
Arsenic, oxide and acids		17,285	14,496
Copper:			
Ore and concentrate		2,588	980
Metal, including alloys:			
Scrap		1,016	933
Unwrought		r 27,059	31,385
Semimanufactures		27,526	37,097
Iron and steel:			
Iron ore and concentrate, except roasted pyrite	thousand tons	23,067	28,775
Roasted pyrite	do	299	277
Metal:			
Scrap	do	17	19
Pig iron, including spiegeleisen [1]	do	139	100
Ferroalloys	do	50	50
Steel, primary forms	do	56	61
Semimanufactures:			
Bars, rods, angles, shapes, sections	do	383	415
Universals, plates and sheets	do	569	575
Hoop and strip	do	44	55
Rails and accessories	do	12	5
Wire	do	50	54
Tubes, pipes and fittings	do	186	231
Castings and forgings, rough	do	1	2
Total semimanufactures	do	1,245	1,337
Lead:			
Ore and concentrate		35,922	48,508
Metal, including alloys, unwrought		13,838	13,672
Oxides		1,963	2,598
Magnesium metal, including alloys, scrap		384	168
Manganese ore and concentrate		4,324	3,089
Nickel metal, including alloys:			
Scrap		731	650
Unwrought		454	485
Semimanufactures		1,295	1,308

See footnotes at end of table.

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Table 2.—Sweden: Exports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS—Continued		
Platinum-group metals and silver:		
Waste and sweepings—value, thousands	$2,939	$3,882
Metals, including alloys, unworked or partly worked:		
Platinum-group—do	$255	$248
Silver—do	$3,605	$9,235
Silicon, elemental	7,013	7,471
Tin metal, including alloys, unwrought—long tons	70	198
Tungsten:		
Ore and concentrate	44	447
Metal	160	112
Uranium and thorium metal, including alloys—value, thousands	$28	---
Zinc:		
Ore and concentrate	127,575	141,703
Metal, including alloys:		
Scrap	1,023	1,364
Unwrought and semimanufactures	454	653
Other:		
Ore and concentrate	38	140
Ash and residues containing nonferrous metals	77,518	78,223
Metallic oxides, ordinarily used for paints, n.e.s.[2]	748	400
Base metals, including alloys, all forms	r 268	171
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc—value, thousands	$42	$3
Dust and powder of precious and semiprecious stones—do	$175	$12
Grinding and polishing wheels and stones	2,030	2,475
Cement	76,528	4,547
Chalk	3,941	2,774
Clays and clay products (including all refractory brick):		
Crude clays	1,236	2,679
Products:		
Refractory (including nonclay bricks)	31,187	30,044
Nonrefractory	32,418	32,048
Diamond:		
Gem, not set or strung—value, thousands	$237	$357
Industrial—do	$57	$39
Feldspar and fluorspar	14,315	14,875
Fertilizer materials, manufactured:		
Nitrogenous	58,546	85,688
Phosphatic, Thomas slag	24,718	32,680
Other, including mixed	16,801	438
Graphite, natural	157	48
Pyrite, gross weight	39,506	41,622
Stone, sand and gravel:		
Dimension stone, crude and partly worked:		
Granite, gneiss, sandstone, etc	110,684	145,123
Marble and other calcareous	5,658	5,927
Slate	1,650	2,609
Dolomite, chiefly refractory grade	4,649	9,421
Gravel and crushed stone	774,801	800,981
Limestone	594,265	472,480
Quartz and quartzite	100,561	104,146
Sand, excluding metal bearing	39,681	38,053
Sulfuric acid, including oleum	32,335	65,338
Talc and steatite	3,823	4,714
Other nonmetals, n.e.s.:		
Mineral materials	4,117	14,908
Slag dross and similar, not metal bearing	68,148	59,749
Chemical elements and inorganic acids [3]	23,803	19,641
Inorganic bases [4]	9,688	22,723
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, excluding briquets	756	804
Coke, including briquets	8,503	8,602
Hydrogen, helium and rare gases	425	208
Peat, including peat briquets	14,053	16,620
Petroleum refinery products:		
Gasoline	216,147	518,812
Kerosine and jet fuel	7,804	109,589
Distillate fuel oil	185,474	401,317
Residual fuel oil	247,573	605,322
Lubricants	45,606	58,442
Other, including liquefied petroleum gases	57,997	58,619
Total	810,601	1,752,101
Mineral tar and other coal petroleum or gas derived crude chemical	37,496	26,598

r Revised.
[1] Includes cast iron and shot, grit, sponge, etc. of iron steel.
[2] Mostly zinc oxide.
[3] Mostly chlorine and hydrochloric acid.
[4] Mostly caustic soda, caustic potash, and artificial corundum.

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Table 3.—Sweden: Principal destinations of selected mineral commodity exports, 1968

(Metric tons unless otherwise specified)

Commodity	Quantity
METALS	
Arsenic oxides and acids, total	14,436
United States	7,865
United Kingdom	4,011
Copper: [1]	
Unwrought, total	31,385
United Kingdom	10,144
Netherlands	7,501
Semimanufactures, total	37,097
United States	14,759
Denmark	10,390
Iron and steel:	
Iron ore, total thousand tons	28,775
West Germany do	12,833
Belgium-Luxembourg do	7,893
United Kingdom do	4,850
Semimanufactures, total [1] do	1,337
United Kingdom do	198
West Germany do	188
Denmark do	155
Norway do	119
U.S.S.R. do	85
United States do	75
Lead:	
Ore and concentrate, total	48,508
West Germany	44,333
Unwrought, total [1]	18,672
Denmark	5,316
West Germany	1,864
Finland	1,608
United States	1,510
Silver, unwrought, total value, thousands	$9,235
United Kingdom do	$5,204
West Germany do	$2,990
Zinc ore and concentrate, total	141,703
Belgium-Luxembourg	47,878
West Germany	37,046
Norway	31,841
NONMETALS	
Gravel and crushed stone (including limestone, quartz, and quartzite), total thousand tons	1,378
West Germany do	709
Denmark do	376
Finland do	238
MINERAL FUELS AND RELATED MATERIALS	
Petroleum products, total do	1,752
Denmark do	752
Norway do	609

[1] Including alloys.

Table 4.—Sweden: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite and concentrates	49,120	41,045
Oxide and hydroxide [1]	86,341	143,757
Metal, including alloys:		
Scrap	1,091	2,133
Unwrought	29,654	24,835
Semimanufactures	25,395	26,079
Chromium:		
Chromite	140,718	149,437
Oxide and hydroxide	1,877	5,252
Cobalt oxide and hydroxide	5	6
Copper:		
Ore and concentrate	62,725	46,263
Matte	17,751	18,885
Metal, including alloys:		
Scrap	6,837	9,572
Unwrought	66,953	80,683
Semimanufactures	18,599	18,803

See footnotes at end of table.

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Table 4.—Sweden: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS—Continued			
Iron and steel:			
Ore and concentrate, except roasted pyrite		3,376	81,553
Roasted pyrite		3,328	5,135
Metal:			
Scrap		94,455	194,126
Pig iron, including cast iron [1]		234,533	278,032
Ferroalloys		62,289	85,680
Steel, primary forms		11,171	14,420
Semimanufactures:			
Bars, rods, angles, shapes, and sections		282,791	326,926
Universals, plates, and sheets		664,386	694,712
Hoop and strip		55,234	60,698
Rails and accessories		7,205	6,540
Wire		16,241	17,358
Tubes, pipes, and fittings		179,572	191,099
Castings and forgings, rough		4,053	6,249
Total semimanufactures		1,209,482	1,303,582
Lead:			
Oxides		1,586	1,591
Metal, including alloys:			
Unwrought		7,694	5,458
Semimanufactures		1,518	1,900
Magnesium metal, including alloys:			
Unwrought, including scrap		706	657
Semimanufactures		102	128
Manganese:			
Ore and concentrate		108,332	87,414
Oxides		620	1,104
Mercury	76-pound flasks	1,189	3,974
Molybdenum:			
Ore and concentrate		3,469	4,396
Metal, including alloys, all forms		24	29
Nickel:			
Matte		979	1,031
Metal, including alloys:			
Scrap		1,380	2,178
Unwrought		12,676	13,984
Semimanufactures		886	986
Platinum-group metals and silver:			
Ore and concentrates	value, thousands	$286	$1,958
Waste and sweepings	do	$484	$3,558
Metals, including alloys, unwrought or partly worked:			
Platinum-group	value, thousands	$1,582	$1,776
Silver	do	$3,652	$4,279
Tin, metal, including alloys:			
Unwrought, including scrap	long tons	689	762
Semimanufactures	do	136	147
Titanium:			
Ore and concentrate		2,791	2,661
Oxides		7,955	5,640
Tungsten:			
Ore and concentrate		914	1,930
Metal, including alloys, all forms		57	39
Zinc:			
Oxide		1,903	2,119
Metals, including alloys:			
Blue powder (dust)		189	251
Unwrought		34,528	38,427
Semimanufactures		1,367	1,537
Other:			
Ore and concentrate		50	2
Ashes, and residues containing nonferrous metal		67,402	48,856
Oxides, hydroxides and peroxides of metals, n.e.s.		1,444	1,653
Metals, including alloys, all forms		2,452	3,131
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc		738	597
Dust and powder of precious and semiprecious stones	value, thousands	$730	$585
Grinding and polishing wheels and stones		3,202	3,195
Asbestos		13,534	18,731
Barite and witherite		1,687	1,285
Boron materials:			
Crude natural borates		4,952	6,362
Oxide and acid		1,111	793
Cement		31,999	23,605
Chalk		9,541	16,650

See footnotes at end of table.

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Table 4.—Sweden: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
NONMETALS—Continued			
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s. (bentonite, kaolin, refractory)		248,656	270,510
Products, refractory (including nonclay bricks)		84,120	93,563
Cryolite and chiolite		1,254	1,275
Diamond:			
Gem, not set or strung	value, thousands	$2,258	$1,928
Industrial	do.	$1,044	$681
Diatomite and other infusorial earths		r 9,640	8,720
Fertilizer materials:			
Crude:			
Nitrogenous		22,386	25,834
Phosphatic		511,832	527,974
Manufactured:			
Nitrogenous		392,099	494,077
Phosphatic		232	18,639
Potassic		215,410	221,389
Other		27,114	42,970
Ammonia		49,878	67,182
Fluorspar, including feldspar		16,324	19,209
Graphite, natural		981	1,107
Gypsum and plasters		364,410	387,077
Lime		20,230	14,446
Magnesite		7,249	6,000
Mica, all forms		989	1,184
Pigments, mineral:			
Natural, crude		228	291
Iron oxides, processed		6,210	6,356
Precious and semiprecious stones, except diamond	value, thousands	$558	$1,017
Pyrite		124,455	63,914
Salt		824,058	937,196
Sodium and potassium compounds, n.e.s.:			
Caustic soda		23,081	57,719
Caustic potash		1,348	1,357
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous stone		8,411	2,970
Slate		6,348	5,378
Other, including granite, gneiss, etc.		1,977	2,876
Worked, all types		24,567	19,694
Dolomite, chiefly refractory grade		24,381	26,168
Gravel and crushed rock		33,723	48,953
Limestone (except dimension)		r 87,022	85,039
Quartz and quartzite		8,503	4,692
Sand, excluding metal bearing		219,202	207,924
Sulfur:			
Elemental, all forms		123,877	148,928
Dioxide, sulfuric acid, and oleum		12,064	36,618
Talc, steatite, soapstone, and pyrophyllite		18,626	18,922
Other nonmetals, n.e.s.:			
Mineral materials		25,002	25,895
Slag dross and similar waste, not metal bearing		15,949	16,735
Oxides and hydroxides of magnesium, strontium, and barium		5,712	8,690
Chemical elements [1]		1,062	2,023
Inorganic acids		10,076	29,279
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		724	1,069
Carbon black		22,919	23,573
Coal and briquets:			
Anthracite and bituminous coal	thousand tons	1,678	1,733
Lignite and lignite briquets		5,926	8,567
Coke and semicoke	thousand tons	1,018	1,074
Hydrogen, helium and rare gases		166	147
Petroleum:			
Crude and partly refined	thousand tons	6,145	9,063
Refinery products:			
Gasoline (including natural)	do.	2,571	2,558
Kerosine and jet fuel	do.	375	385
Distillate fuel oil	do.	6,309	6,904
Residual fuel oil	do.	6,927	7,039
Lubricants	do.	146	146
Other, including liquefied gases	do.	111	147
Total refinery products	do.	16,439	17,179
Mineral tar and other coal, petroleum, or gas derived chemicals		30,174	26,598

r Revised.
[1] Excluding artificial corundum.
[2] Includes spiegeleisen and sponge, powder, and shot of iron and steel.
[3] Mostly chlorine.

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Table 5.—Sweden: Principal sources of selected mineral commodity imports, 1968
(Thousand metric tons)

Commodity	Quantity	Commodity	Quantity
METALS		NONMETALS	
Chromite, total	149	Clays, crude, total	271
U.S.S.R	114	United Kingdom	238
Copper:		Diamond, all types, total	
Ore and concentrate, total	46	value, thousands	$2,609
Canada	22	Belgium-Luxembourg ...do	$1,201
Peru	10	Netherlands ...do	$578
Matte, total	19	United Kingdom ...do	$317
France	12	Fertilizer materials:	
Unwrought, total [1]	81	Phosphatic crude, total	528
Chile	35	Morocco	395
Zambia	22	U.S.S.R	98
Belgium-Luxembourg	12	Nitrogenous, manufactured, total	494
Iron and steel:		Norway	434
Pig iron, total	278	Netherlands	52
Finland	147	Potassic, manufactured, total	221
U.S.S.R	80	East Germany	56
Semimanufactures, total	1,304	Canada	58
West Germany	287	West Germany	35
United Kingdom	206	Salt, total	937
France	186	Netherlands	396
Belgium-Luxembourg	175	West Germany	258
Manganese ore, total	87	MINERAL FUELS AND RELATED MATERIALS	
South Africa	44	Petroleum, crude, total	9,068
U.S.S.R	21	Muscat-Oman	1,218
Silver, unwrought, total [1]		Kuwait	648
value, thousands	$4,279	Qatar	604
United Kingdom ...do	$2,105	U.S.S.R	443
West Germany ...do	$1,897	Iraq	397
Zinc, unwrought, total [1]	38	Algeria	91
Norway	18	Refinery products, total	17,179
Poland	8	U.S.S.R	4,337
		United Kingdom	3,411
		Trinidad	1,718

[1] Including alloys.

COMMODITY REVIEW

METALS

Aluminum.—Output of primary metal in 1969 represented maximum capacity of the Sundsvall smelter, which was the only primary reduction facility in Sweden. The plant was operated by AB Svenska Aluminium Kompaniet (SAKO), a subsidiary of AB Svenska Metallverken (SM). After raising production capacity in 1968, SAKO was again expanding the plant in 1969, this time to an annual capacity of 85,000 tons. The project will be completed by yearend 1970, at a cost of approximately $11.6 million.

Increased imports of bauxite in 1969 suggested that capacity for manufacturing alumina had also increased. Imports of bauxite totaled 67,000 tons, a 63-percent increase compared with 1968. Total imports of aluminum oxide and hydroxide were relatively unchanged, at 148,000 tons. Jamaica, Guyana, and Greece continued to be the principal sources.

SAKO also increased production capacity at its remelting works and foundry at Månsbo in 1969, from 7,000 tons to 15,000 tons annually. The expansion cost approximately $1.3 million, half of which was loaned by the State under its regional development policy. The Månsbo plant produced 8,500 tons of foundry aluminum in 1969.

Imports of unwrought aluminum (including alloys) rose to 35,000 tons, 40 percent more than in 1968; exports were relatively unchanged at 16,000 tons. Most of this trade continued to be conducted with Norway. Swedish consumption of primary metal in 1969 was approximately 76,000 tons, more than 20 percent above the previous year. Total consumption of aluminum was estimated at 118,000 tons.

Output of aluminum semimanufactures was estimated at 75,000 tons in 1969, an increase of more than 20 percent compared with 1968. SM accounted for about 85 percent of Swedish production, with the remainder produced by other firms such as AB Skandinaviska Profiler and AB Elektrokoppar. Most of SM's output was produced at the company's Finspång plant, although semimanufactures for aluminum plate, wire, and extrusions are also supplied by SAKO. These products were distributed to SM fabricating plants at Skultuna, Korsnäs, Monsterås, Väsby, and Södertälje in Sweden, and to subsidiaries in Norway and Finland.

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The Södertälje plant, which was acquired by SM in 1969 through purchase of Wedaverken AB from AB Bofors, was merged with SM's Väsby division under the new name of Essem Weda AB. The new firm will concentrate on production of castings in aluminum, magnesium, and zinc.

SM was investing $54 million in additional facilities at Finspång. A new melting furnace was completed in 1969, and in 1970, two more extrusion presses and a second casting machine for wide aluminum strip will be installed. Capacity of the mill, which is currently Sweden's only producer of sheet, was expected to increase to more than 80,000 tons of semimanufactures annually. At Skultuna, SM was building a new foil-rolling mill that will double production capacity (to 4,000 tons annually) by the fall of 1970.

Trade in aluminum semimanufactures was considerably above the levels of 1968. Imports increased 23 percent, to 32,000 tons; exports rose 42 percent to 26,000 tons. Net imports increased nearly 50 percent.

In a major corporate transaction, SM was acquired in 1969 by Trafik AB Grängesberg-Oxelösund (TGO) one of the largest privately owned Swedish steel companies. By yearend, TGO held 78.2 percent of SM shares; 20.8 percent continued to be held by Alcan Aluminium Ltd. of Canada.

Copper.—Increased copper mine output was largely attributable to a full year of production at the Aitik mine in Norrbotten County. The mine is Boliden Aktiebolag's largest, yielding approximately 2 million tons of ore annually containing 0.5 percent copper. The mine supplied nearly 40 percent of Sweden's total mine output of copper in 1969.

Boliden was considering expansion of the Aitik mine capacity to 5 million tons per year by deepening open pit operations to 400 feet. The expansion would include mining of leaner ores, which would drop the average metal content to 0.4 percent copper. The investment cost for the proposed extension was estimated at about $30.2 million. Reserves to the 400 foot level are 150 million tons, assuring Aitik a 30 year operation at 5 million ton annual capacity. To achieve the proposed expansion, about 2.5 million tons of overburden will have to be removed. The expansion program will include crushing and flotation operations as well as service facilities. Boliden also continued to study the economic feasibility of underground mining at Aitik. Mineralization extends to at least 2,000 feet depth, possibly adding an additional 200 million tons of reserves grading 0.5 percent copper.

Sweden's only electrolytic copper producer, the Rönnskär smelter of Boliden, achieved a record production of 51,800 tons in 1969 (nominal rated capacity 50,000 tons per year). The increased output of copper concentrates from the Aitik mine raised the quantity of copper metal produced at Rönnskär from materials furnished by Boliden's own mines to 20,000 tons from a level of only 12,600 tons in 1968. The remainder of Rönnskär's output was produced from purchased domestic and imported concentrates, matte, and scrap. In 1969, Swedish imports of copper ore and concentrates, matte, and scrap increased by 12.2 percent, 32.6 percent, and 34.2 percent, respectively, over those of 1968, totaling 51,903 tons, 25,039 tons, and 12,841 tons. In the case of ore and concentrates, however, the 1969 imports level remained considerably below the levels recorded during the mid-1960's (63,000 to 75,000 tons per year).

At Rönnskär, Boliden was increasing output capacity for blister copper to 60,000 tons annually. The 10,000-ton expansion was scheduled for completion in mid-1970. Electrolytic refining capacity will remain at the nominal 50,000-ton level.

In contrast to the pattern noted for crude copper materials, imports of refined unwrought copper fell by nearly 10.2 percent in 1969 to 62,347 tons as domestic output was better able to meet demand; imports of unwrought copper alloys, as well as of semimanufactures of copper and copper alloys increased only slightly, totaling 3,071 tons and 20,330 tons respectively.

Domestic copper fabricators, the largest of which was Svenska Metallverken AB, produced an estimated 150,000 tons of semimanufactures in 1969. About half of this output was in the form of bars, rods, shapes, sections, and copper wire; about 30 percent was in the form of plate, sheet, and copper strip. Exports of semimanufactures decreased from 37,097 tons in 1968 to 35,078 tons in 1969. About half of all exports were in bars, rods, angles, shapes, and sections. Exports of copper foil decreased from about 15,500 tons in 1968 to nearly 7,000 tons in 1969.

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Complex Ores of Copper, Zinc and Other Metals.—Boliden Aktiebolag's production of sulfide ores, excluding those from the Aitik mine, totaled 3.5 million tons obtained from 22 mines, including those operated by Boliden under Government lease. Other sulfide-ore-producing companies include Stora Kopparberg Bergslags AB, AB Statsgruvor and Bolaget Vielle Montagne. Combined ore output from mines of these companies probably totaled about 500,000 tons in 1969.

Additional surveying or development work was conducted at many Boliden-operated mines during the year. Company ore prospecting expenditures reached an all-time high of $1.8 million. Near yearend, development work was completed at Näsliden; this mine is expected to yield 200,000 tons of copper-zinc-pyrite ore annually. The Boliden concentrator capacity was expanded from 700,000 to 900,000 tons per year permitting simultaneous dressing of three different ore types.

Stora Kopparberg Bergslags AB placed the Falun mine and concentrator under modernization and expansion. When the expansion program is completed output will reach 200,000 tons of copper, zinc, lead, and pyrite ores annually.

At the Nygruvan mine of Vieille Montagne, a shaft was sunk and equipped for personnel and rock hoisting from the 735-meter level. A Guldsmedshyttan crusher, especially designed for lowering down small dimension shafts, was installed at the 665-meter level. A communicating tunnel from the Knalla mine was opened at the 250-meter level, concentrating all rock hoisting through the Nygruvan shaft.

A new shaft was under construction at the Långsele mine for the purpose of deep exploration. Continuing surveys were also conducted at Kimheden lead-copper-zinc-pyrite mine and at the Government-owned Rävlidmyr and Rävliden properties (copper-zinc-lead-pyrite) for which Boliden obtained a new 20-year lease.

As a result of deep exploration in the Garpenberg North ore body, Boliden decided at yearend to engage in extensive development of the ore, which has a high content of silver.

Iron Ore.—Both production and exports of iron ore in 1969 exceeded the record levels of 1968, despite a strike that caused an estimated 1.5-million-ton loss of production at the mines of LKAB in December. The lost time at LKAB mines was partly offset by increased productivity, and gains in production were also reported from central Sweden by TGO and SKB. Total shipments, including approximately 31.7 million tons for export and 4.6 million tons for the home market, exceeded production by 3.1 million tons; consequently, stocks of iron ore were reduced to 5 million tons by yearend. Total shipments of iron ore products included 28.5 million tons by LKAB; 3.96 million tons by TGO; and 935,000 tons by SKB. Exports accounted for nearly 97 percent of the LKAB total and 63 percent of TGO deliveries; shipments of SKB were all for domestic consumption. Deliveries by LKAB and TGO to foreign and domestic markets in 1969 were reported as follows, in thousand metric tons:

Deliveries	LKAB	TGO
For export:		
West Germany	11,700	1,054
Belgium-Luxembourg	8,300	743
United Kingdom	4,000	847
Other *	3,561	371
For domestic consumption	926	1,445
Total	28,487	3,960

* Estimate.

Direct-shipping lump ore made up 62 percent of total output in 1969; ore fines and concentrate made up 19 percent each. Output of pellets increased by 28 percent to 4,075,000 tons, and production of other sintered agglomerates was unchanged at 3.43 million tons. Increased output of pellets was mainly due to commissioning of the Svappavaara pelletizing plant in mid-1969. The grate-kiln plant produced 590,000 tons of pellets in 1969 and has an annual capacity of 1.8 million tons. There was also increased output of pellets at Malmberget (1.01 million tons) and at Kiruna (1.73 million tons). In central Sweden, TGO's production of conventional pellets at Stråssa declined to 440,000 tons because of a shortage of concentrate, but pilot-plant output of cold-bonded pellets increased to 30,000 tons and deliveries amounted to 56,000 tons. TGO expected to complete the commercial-scale plant for production of cold-bonded pellets in early 1970 and an output of 500,000 tons was anticipated by yearend. The plant will have an annual capacity of 1.6 million tons.

In mine developments, the Zenobia open pit at Kiruna was closed in November

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after reaching a depth of about 425 feet. The mine had produced 1.6 million tons of high-phosphorus ore in 1968. Open pit operations will continue at Haukivaara, where 400,000 tons were produced in the same year. In central Sweden, AB Statsgruvor was closing its mine at Intrånget, while SKB and AB Dannemora Gruvor were increasing production. The Dannemora company expected to double mine output in 1971, with an annual yield of 600,000 tons of lump ore and 400,000 tons of fines and concentrate. SKB, which operated five mines in 1969, planned to increase production by more than 50 percent (to 1.4 million tons annually) by 1975.

LKAB was reportedly investing $17.5 million to increase ore handling and shipping facilities at the Norwegian port of Narvik to a capacity of 35 million tons annually by 1973. Shipments from Narvik in 1969 totaled 21.7 million tons. Shipments from the Baltic port of Luleå rose to 7.1 million tons, compared with 3.9 million tons in 1968.

Prices for Swedish iron ore remained low, despite the increasing proportion of beneficiated products. The statistical mean price for iron ore products reportedly declined about 0.8 percent, and the Swedish producer-price index for iron ore (1963=100) was quoted at 81, compared with 83 in 1968. Early in 1969, Swedish producers were reported to have lowered prices for pellets by 5 percent, in contracts with West German steel companies. TGO reported that the bulk of its iron ore deliveries in 1969 were at prices unchanged from 1968, but for the first time in 13 years, the company expected prices to rise significantly in 1970. Although higher prices were possible, the volume of Swedish shipments may be reduced in 1970 because the strike in Kiruna was not settled at yearend. Average export values in U.S. dollars per metric ton, of Swedish iron ore products (f.o.b. Swedish frontier) in 1968 were approximately $6.97 for lump ore, $7.05 for fines and concentrate, and $12.55 for pellets and sinter.

Domestic consumption of iron ore and concentrates in 1969 included 4,236,000 tons in blast furnaces, 249,000 tons in sponge iron plants, and about 200,000 tons in steel furnaces.

Pig Iron, Sponge Iron, and Ferroalloys.—Although the national output of pig iron was only slightly above the 1968 level, production by TGO increased by 12 percent in 1969 to a total of 862,000 tons. The company's output at Oxelösund, where a new hot-blast stove was completed, was 803,000 tons and the remainder was produced at Guldsmedshyttan. Output of pig iron by the other major producers, SKB at Domnarvet and Norrbottens Järnverk at Luleå, was not available. Net imports of pig iron declined to 190,000 tons in 1969, compared with 237,000 tons in 1968.

Output of sponge iron returned to the relatively high levels of 1965–66, as foreign and domestic demand increased. Exports rose 25 percent, compared with 1968, to 70,000 tons; 4,000 tons was imported to augment local supplies. Höganäs AB, the principal producer, reported in 1969 that the rapid growth in demand for iron powder exceeded the company's production capacity for sponge iron, and that imports would continue until a new tunnel-furnace was completed at Höganäs in late 1970. Deliveries of iron powder by this firm totaled 74,000 tons in 1969, an increase of 36 percent over the previous year. Increased output of sponge iron was also reported by TGO at Oxelösund (36,000 tons), and Uddeholms AB was increasing productive capacity. The latter company produced 28,000 tons in 1967. Other companies producing sponge iron included SKB (at Söderfors), SKF (at Hofors), and Sandviken Jernverks AB.

Under contract with AB Järnförädling of Hälleforsnäs, TGO will produce sponge iron-magnesium briquettes, for use in foundries producing spheroidal-graphite (SG) cast iron. The use of sponge iron as a vehicle for magnesium, as developed by Järnförädling, was said to be cheaper and more efficient than the use of nickel or ferrosilicon. Magnesium content of the briquettes will be about 15 percent.

Under a contract signed in 1969, TGO will supply to SKF 500,000 tons of high-purity iron, including pig and sponge iron.

AB Ferrolegeringar, the main Swedish producer of ferroalloys, bought the ferrochromium plant of Wärgons AB at Trollhättan, effective January 1, 1970. Output capacity of the plant was approximately 20,000 tons of ferrochromium annually.

Steel.—The 1969 output of crude steel and semimanufactures increased 4.5 and 6 percent, respectively; imports of steel increased 30 percent, and Swedish consump-

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tion showed the first significant rise in several years. Apparent consumption was approximately 4.1 million tons, compared with 3.5 million tons in 1968. Most of the increased demand appeared to come from the domestic market because the total tonnage of exports was almost unchanged from 1968. The value of exports, however, increased by 14 percent, and the trade surplus attributable to iron and steel in 1969 was approximately $20 million.

Output of crude steel at Oxelösund rose 7 percent, to 764,000 tons in 1969. Production capacity increased 28 percent, to 900,000 tons annually, as modifications to the Kaldo plant were completed, allowing two furnaces to be operated simultaneously. TGO also decided in 1969 to raise the plant's capacity for heavy plate by 15 percent, to 625,000 tons annually. Production of heavy and medium plate was 530,000 tons in 1969.

Output of steel at the Domnarvet works of SKB was also reported to have increased by 7 percent. This company produced 906,000 tons in 1968, and had a total output capacity of 1.2 million tons annually. Production by state-owned Norrbottens Järnverk AB, the nation's third largest producer, was not available, but a $6 million operating loss was reportedly sustained by the company in 1969. Smedjebackens Valsverk AB increased steel output by almost 30 percent to 245,000 tons in 1969, after installing a 120-ton electric arc furnace, which was reported to be the largest in Scandinavia.

Steel production from electric furnaces continued to account for the largest share of total output, as well as for the most rapid rate of growth. Total output from oxygen converters (Kaldo and Linz-Donawitz) also rose, but production of open-hearth and Thomas steel continued to decline. Approximate shares of Sweden's crude steel output, by process, are shown in the following tabulation (in percent).

Process	1967	1968	1969
Electric:			
Arc	33.0	35.2	37.2
Induction	3.6	3.9	3.9
Oxygen	32.8	32.9	32.8
Open-hearth:			
Acid	19.7	18.0	16.6
Basic	8.9	9.1	8.8
Thomas	2.0	.9	.7
Total	100.0	100.0	100.0

SKB announced a decision in 1969 to invest $16 million for construction of a 60-inch cold-rolling mill at Domnarvet. The mill will have an initial capacity of 500,000 tons annually. A sixth stand was added to the wide-strip mill at Domnarvet in 1969. Fagersta Bruks AB began operating a new L-D converter in mid-1969, and will build a new rolling mill for wire rod at Långshyttan during 1971. Scandia Plate AB, a joint company for marketing heavy plate made at Oxelösund and Domnarvet, was formed by TGO and SKB and will commence operations on January 1, 1970. In other developments, TGO continued to receive orders for large-diameter (1-meter) pipe from the Soviet Union at the rate of about 40,000 tons annually. The company also formed a Canadian subsidiary (Gränges Nyby Canada Ltd.) to build and operate a pipe-welding mill in Brockville, Ontario.

Special Steel.—Production, exports, and imports of special steel continued to rise in 1969. The increased output and trade took place mainly in alloy steels, where production of crude forms rose 13.5 percent (to 1,238,000 tons); exports of semimanufactures increased 13 percent (to 297,000 tons); and imports of semimanufactures climbed 45 percent (to 49,000 tons), compared with 1968. Production and trade of unalloyed, high-carbon steel were only slightly above levels of the previous year. The largest gains in production were registered in heat-treatable and case-hardening steel (up 27 percent), high-speed steel (up 40 percent), and ball-bearing steel (up 13 percent). Output of special steels, by type, in 1969 is shown in the following tabulation, along with the share (in percent) of each type in total output. Quantities are expressed in thousands of metric tons.

Type of steel	Production	Percent
Unalloyed, high-carbon	216.2	14.8
Alloyed:		
Stainless	366.5	25.2
Heat-treatable [1]	296.0	20.4
Tool [2]	95.4	6.6
High-speed	24.2	1.7
Free-machining	11.8	.8
Other, including ball-bearing steel	444.4	30.5
Total alloyed	1,237.8	85.2
Grand total	1,454.0	100.0

[1] Including case-hardening and spring steel.
[2] Excluding high-speed steel.

Source: Järnverksföreningen (Stockholm). Svensk Järnstatistikk; Produktion, export och import 1969.

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Production of special steels by the ladle furnace/vacuum refining process, developed by Allmänna Svenska Elektriska Aktiebolaget (ASEA) and AB Svenska Kullagerfabriken (SKF), was increasing. Since 1965, when the first 30-ton unit was installed at the Hellefors works of SKF, units of 30-to 60-ton capacity have been installed by other Swedish companies at Bofors, Fagersta, Domnarvet, Nyby, and Hagfors, as well as a second unit at Hellefors. Two more units were scheduled for installation in 1970, a 30-ton furnace at Söderfors and a 130-ton unit at Oxelösund. The ASEA-SKF process, which is claimed to increase productivity by about 30 percent, was also installed or ordered by steel companies in Brazil, Japan, Belgium, and the United States in 1969. Nine 90-ton ladle furnaces were reportedly ordered by Allegheny-Ludlum Steel Corp.

An improved method of producing high-speed and high-alloy tool steel was reportedly developed by SKB at Söderfors, in cooperation with ASEA. The process uses steel powder to produce billets, which were said to be easier to forge and to roll than conventional ingots. The potential life of tools made from such billets was reportedly increased by as much as 380 percent.

Among other developments, Fagersta Bruks AB decided in 1969 to build a continuous casting machine and hot-rolling mill for special steel strip at Fagersta, and a cold-rolling mill at Långshyttan. Sandvikens Jernverks AB was producing a hardened steel strip called "Hardflex", which combines great hardness with the ability to be cold-formed. AB Bofors announced development of a low-sulfur (0.001 percent) steel, made with cerium, which was applicable to space and military uses.

Lead and Zinc.—Domestic production of lead concentrates totaling 107,800 tons was derived principally from Boliden mines at Laisvall and Vassbo. The company's reserves of lead ore were increased by about 20 percent (to 35 million tons) because of additional finds in the Laisvall area. Most of Sweden's output of lead concentrate was refined at Rönnskär; 46,870 tons was exported. Primary lead production has retained stable in recent years with output reported at 42,100 tons in 1969. Swedish production of red lead declined by 20 percent to 2,500 tons in 1969 because of unfavorable market conditions.

Zinc concentrate production increased by more than 14 percent, totaling 160,700 tons. Virtually all production was exported, with most destined for smelters in Norway, Belgium, and West Germany. Zinc-bearing slag obtained from smelting of copper and lead at Rönnskär is processed to yield an intermediate product (clinker) containing 70 to 75 percent zinc. Clinker production totaled 29,500 tons in 1969. The clinker is exported to Det Norske Zinkkompani A/S, a Norwegian smelter 50 percent owned by Boliden.

Precious Metals.—Production of gold and silver at Rönnskär continued to account for all reported national output. Boliden-operated mines produced 38 percent of the total output of gold, and 42 percent of the silver; the rest came from purchased materials obtained from domestic and foreign suppliers.

Tungsten.—AB Statsgruvor, a State-owned company, acquired the properties of AB Yxsjö Gruvor in 1969 and was preparing to reopen the Yxsjöberg mine. Production was scheduled to begin in 1971 at the rate of 150,000 tons of ore annually. The mine will reportedly produce fluorspar as well as tungsten and copper. The mine was last worked in 1963 when 92,000 tons of ore were produced, yielding approximately 330 tons of tungsten concentrate.

Uranium and Nuclear Energy.—The open pit mine and uranium extraction plant at Ranstad continued to operate at approximately 40 percent of rated capacity in 1969, under a 3-year program designed to establish the lowest possible cost of extracting uranium from low-grade (0.03 percent U) deposits in the Billingen shale. If the production cost (currently, about $11 per pound of U_3O_8) can be lowered enough to compete with foreign producers, the State-controlled operating company, AB Atomenergi, would propose to expand production capacity by 1980 to 600 or 1,200 tons uranium per year from the present 120-ton level. The decision to expand would be made by 1974. However, the Ministry of Industrial Affairs, while recognizing that output from Ranstad might provide more than half of the anticipated Swedish demand for uranium (estimated at 1,800 tons annually by 1980), thought the total cost of such an expansion would be too high considering the present uranium market and uncertainties concerning that market in the 1980's. The Ministry fa-

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vored keeping the Ranstad facilities available, and continuing development work, while obtaining the necessary supplies of uranium from foreign sources.

Meanwhile, prospecting for additional resources of uranium was continued. The Swedish Geological Survey's budget for this purpose in 1969–70 was approximately $310,000, compared with $118,000 in the previous year. In addition to the large known resources in the Kvarntorp and Billingen areas, uranium deposits of possible commercial significance were reportedly found by AB Atomenergi, in shale of the Tasjö region in northwest Sweden.

Output of nuclear energy remained small in 1969. The Ågesta heating works, which supplies hot water to the Stockholm suburb of Farsta, was operated for 6,600 hours during 1969, after being closed down for much of 1968. The Ågesta powerplant, with a net generating capacity of only nine megawatts of electricity (MWe), was commissioned in 1968. At the Marviken powerplant, 80 miles southwest of Stockholm, testing and modification work may delay the start of production until 1971. The plant, with a rated output (minimum) of 132 MWe, was originally scheduled to go critical in late 1969. Another 70 miles to the south, construction of the first Oskarshamn unit (400 MWe) was continued at Simpevarp; initial output of power was expected in late 1970. A second Oskarshamn unit (580 MWe) was scheduled for completion in 1974. Meanwhile, construction of the first Ringhals plant (750 MWe) was continued south of Göteborg, and a second unit (800 MWe) was on order. The first reactor (580 MWe) for the Barsebäck plant, north of Malmö, was also ordered from Asea-Atom by Sydsvenska Kraft AB in 1969. In all, 13 nuclear powerplants were under construction or planned, as indicated by the following tabulation:

Plant	Owner	Approximate generating capacity (MWe)	Approximate completion date
Marviken [1]	AB Atomenergi	132	1970
Oskarshamn I [1]	Oskarshamnverkets Kraftgrupp AB	400	1970
Ringhals I [1]	State Power Board	750	1973
Ringhals II [2]	do.	800	1974
Oskarshamn II [2]	Oskarshamnverkets Kraftgrupp AB	580	1974–75
Barsebäck I [2]	Sydsvenska Kraft AB	580	1975
Trosa I	State Power Board	800	1976
Värtan	Stockholms Elverk	500	[3] 1976–77
Gävle I	Krångede AB	600	[3] 1977
Göteborg	Göteborg City/State Power Board	750	[3] 1977
Barsebäck II	Sydsvenska Kraft AB	750	1978
Trosa II	State Power Board	750	1979
Gävle II	Krångede AB	750	[3] 1980

[1] Under construction.
[2] On order.
[3] Tentative.

Principal sources: (1) Dagens Nyheter, July 29, 1969.
(2) AB Atomenergi, Annual Reports.

Oskarshammverkets Kraftgrupp AB (OKG) announced that a preliminary agreement had been reached with the French atomic energy agency (CEA) for the purchase of about 500 metric tons of uranium hemafluoride for approximately $9.7 million. OKG also obtained an option for an additional 1,000 tons. Deliveries were scheduled from 1972 to 1980. Under an agreement between OKG and the United States Atomic Energy Commission, the uranium would be enriched in the United States. By yearend, an agreement was also signed between the Swedish Government and the Soviet Atomic Energy Committee providing for toll enrichment services in the U.S.S.R. for uranium furnished by Sweden. Under this agreement, the enriched uranium may contain up to 5 percent U-235, and the price of the services may not exceed the world market price for such services at the time of delivery.

Vanadium.—Feasibility of extracting vanadium from deposits of titaniferous magnetite at Smålands Taberg, in south-central Sweden, was being investigated in 1969 by an unspecified group. The Taberg deposits have been reported to contain upwards of 300 million tons of material averaging approximately 32 percent iron, 6 to

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7 percent titanium, and 0.16 percent vanadium. Mining of the deposits was last reported in 1961.

NONMETALS

Cement and Other Construction Materials.—Activity in the cement industry appeared to be relatively static in 1969, despite predicted increases in investment, planned expansions of productive capacity, and gains of 3 to 7 percent in building starts and completions. Exports of cement rose by 55,000 tons, but imports dropped by 40 percent compared with 1968. Imports of gypsum and plasters were 3 percent above the 1968 level.

In southern Sweden, Höganäs AB was investing $2 million to increase productive capacity for refractory brick. Höganäs supplies about two-thirds of Swedish demand, which was estimated at 150,000 tons in 1969. Annual demand was expected to grow to 180,000 tons by 1975.

The Höganäs firm also completed a new washing plant for kaolin at Näsum early in 1969. Output of this plant, which had a productive capacity of 30,000 tons annually, was probably responsible for sharp increase in production of washed kaolin in 1969.

Industrial minerals were mined at about 11 localities by Höganäs in 1969. Among other minerals, the company reportedly produced 55,000 tons of chamotte; 25,000 tons of olivine; 40,000 tons of soapstone; and 150,000 tons of fire clay. These quantities exceed those reported in official preliminary statistics (olivine is not listed) and may represent crude ore production.

At Kvarntorp in central Sweden, sandstone was being mined underground by Ytong AB, at the rate of 250,000 to 325,000 tons annually. The Ytong company, producer of precast building components and high-silica products, had purchased most of the former oil-shale processing facilities at Kvarntorp from AB Svenska Skifferolje in 1965.

Pyrite and Sulfur.—Expansion of production capacity and rationalization of the pyrite and sulfur industry continued in 1969. The Boliden Co., which accounts for most of the national output, produced an estimated 445,000 tons of pyrite in 1969, and by yearend had centralized all roasting operations at Hälsingborg. The Hälsingborg works, operated by the Reymersholms division of Boliden, produced 405,000 tons of sulfuric acid, and an additional 148,000 tons was produced from smelter gases at Rönnskär. During the year a new sulfuric acid plant, with a production capacity of 250,000 tons per year, was completed at Hälsingborg; a second plant, of the same capacity, was under construction and was scheduled for completion in 1970. Total capacity of the Hälsingborg works in 1971 was expected to be 800,000 tons of sulfuric acid per year. With expansion of capacity at Hälsingborg, two older plants with an aggregate capacity of 115,000 tons per year were being closed at Norrköping and Oskarshamn; the former was closed in 1969 and the latter was scheduled to close in March 1970. The Reymersholms works now supplies all sulfuric acid required by AB Förenade Superfosfatfabriker, the principal Swedish producer of fertilizer that is also controlled by Boliden. Important byproducts of Hälsingborg roasters include about 300,000 tons of arsenic-free iron oxide, most of which is exported to West Germany and the United Kingdom, and electric energy, which is sufficient to supply most of the power required by the Reymersholms plants.

Concurrently, plants for production of liquefied sulfur dioxide were also being built at Hälsingborg and Rönnskär. The Hälsingborg plant will have a production capacity of 55,000 tons per year and will come in stream in 1970. The Rönnskär plant will have a capacity of 30,000 tons per year and will begin production in 1971. The liquefied SO_2 is intended for the pulp industry, where its use is increasing in preference to pyrite and elemental sulfur. Swedish capacity for production of liquid SO_2 was expected to be at least 125,000 tons per year by 1971.

Sweden's production of pyrite concentrate was expected to increase by at least 30 percent during the next 2 or 3 years. With new production from the Näsliden mine and expansion of the Boliden concentrator in 1969, and expansion of production planned at the Kedträsk deposit, the Boliden Co. anticipated an annual output of 600,000 tons. Pyrite, SO_2, and sulfuric acid is also produced at Falun by SKB.

Imports of elemental sulfur declined to 87,000 tons in 1969. Most was obtained from Poland and France. Imports of pyrite were doubled, but exports were not appre-

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ciably changed compared with 1968. Net exports of sulfuric acid increased to 91,000 tons in 1969.

MINERAL FUELS

Coal and Coke.—Sweden's small output of coal was a byproduct of clay mining operations in the southwest. Höganäs AB was the principal producer. No coal mines have been operated in Sweden since the Nyväng mine was closed by the company in 1966.

Imports of coal decreased about 9 percent, and imports of coke increased 2.5 percent compared with levels of 1968. The United States remained the largest supplier of coal, with 568,100 tons, but its share of the market dropped to 36 percent, compared with 41 percent in 1968. Shipments from West Germany (200,000 tons) also declined, as imports from the Soviet Union (488,400 tons), Poland (266,800 tons) and the United Kingdom (83,400 tons) increased.

Output of metallurgical coke at the Oxelösund steelworks in 1969 rose to 504,000 tons. In imports of coke, West Germany remained the major supplier with 475,000 tons and a 43-percent share of the market, compared with 665,000 tons and a 62-percent share in 1968.

Domestic consumption of coal and coke in 1967 and 1968 is shown by the following tabulation, in thousand metric tons:

Commodity and consuming sector	Consumption 1967	1968
Coal:		
Coke ovens	706	670
Gas works	621	560
Thermal powerplants	20	-----
Railways	4	10
Industry [1]	467	350
Other	68	60
Total	1,886	1,650
Coke-oven coke:		
Iron and steelmaking [2]	1,262	1,280
Railways	4	7
Other industry	250	185
Other	251	150
Total	1,767	1,622
Gas coke:		
Gasworks	85	79
Industry	214	240
Other	200	174
Total	499	493

[1] Includes 50,000 tons consumed by iron and steel industry exclusive of casting plants.
[2] Includes approximately 500,000 tons transformed into blast furnace gas.

Source: Organization for Economic Cooperation and Development (OECD) (Paris). Statistics of Energy 1954–68, 1970, pp. 226–229.

Petroleum.—*Exploration.*—AB Oljeprospektering, the oil and gas prospecting firm whose formation was reported in 1968, began geophysical surveys in the southern province of Skåne in late 1969. The company plans expenditures of about $20 million during the next 5 years, and a further $10 million by 1977. Exploration work was expected to concentrate in Skåne, the Bay of Hanö, and in the maritime area around Gotland. In Skåne, drilling may start during 1970.

Refining and Marketing.—With the recent expansion of refining capacity and petrochemical facilities in western Sweden, imports of crude oil rose more than 14

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percent in 1969, to nearly 10.3 million tons, and output of petroleum products was 11.5 percent more than in 1968.

At yearend, petroleum refining capacity was 12.4 million metric tons per year distributed among five refineries as follows:

Company	Location	Annual capacity (million tons)
British Petroleum Raffinaderi AB	Göteborg	5.0
Koppartrans Oljeaktiebolag (Shell)	do	4.3
AB Nynäs-Petroleum	Nynäshamn	2.7
	Göteborg	.3
	Malmö	.1
Total		12.4

Source: Petroleum Times. V. 74, No. 1888, Jan. 2, 1970, p. 77.

The Oljekonsumenterna (OK) cooperative apparently made final plans to build a refinery at Lysekil, north of Göteborg. The plant will have a refining capacity of 5 million tons per year; completion was expected by late 1972. The OK organization's share of the Swedish market for petroleum products was about 17 percent in 1969.

In petrochemical developments, AB Svenska Esso completed its large (250,000-ton) plant at Stenungsund; AB Fosfatbolaget and Unifos Kemi AB were expanding annual capacities to 160,000 tons and 110,000 tons, respectively; and Uddeholms AB was building a 24,000-ton plant. Mo och Domsjö AB reportedly had a 40,000-ton-per-year capacity.

Plans were made to build a 100-mile pipeline system for petroleum products from Göteborg to Örebro in central Sweden. The system will consist of two 10-inch pipelines, one for white products and the other for (heated) heavy fuel oil. The lines will be built by Björklund and Wedin, with pipe supplied by the Hedlurfd division of TGO.

Consumption of petroleum products continued to increase, particularly gasoline and fuel oils. Total number of cars, trucks, and buses rose by 10 percent to 2.5 million in 1969. Inland consumption of petroleum products in 1968 and 1969 was reported as follows, in thousand metric tons:

Commodity	Consumption	
	1968	1969
Gasoline	2,521	2,633
Kerosine	213	216
Distillate fuel oil	7,606	8,250
Residual fuel oil	10,248	11,959
Other	r 1,464	1,633
Total	r 22,052	24,691

r Revised.

Source: Organization for Economic Cooperation and Development. (OECD) (Paris). Provisional Oil Statistics by Quarters; From 1st Quarter 1967 through 4th Quarter 1969, Paris 1970, 22 pp.

Electric Power.—Output of electricity increased by 3.2 percent in 1969, to 58 billion kilowatt-hours (Kwhr). The share of total output contributed by thermoelectric plants (most of which burn fuel oil) rose to 28 percent, compared with 13 percent in 1968, owing to less favorable hydraulic conditions. Although output from nuclear plants is increasing, it accounted for only about 1 percent of the total output, and imports of 5 billion Kwhr were required to augment the nation's supply.

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The Mineral Industry of Taiwan

By R. A. Pense [1]

Lacking extensive mineral resources, Taiwan's mineral industry in 1969 became increasingly engaged in processing such foreign raw materials as crude petroleum, steel scrap, bauxite, and phosphate rock to meet national needs. The cement industry continued to be the principal mineral industry sector using domestic materials. Together with the chemical fertilizer industry, these processing industries had an added value at least three times the production value of the extractive sector. Coal accounted for about 63 percent of mine output value, although for the first time in recent years it declined significantly in quantity.

The first year of the fifth 4-year plan (1969–72) ended fairly successfully in 1969 with a gross national product (GNP) preliminarily estimated at $4,125 million (in 1964 prices). This represented an 8.7-percent increase over GNP in 1968, and it was above the overall 7-percent annual growth rate projected for the plan. The extractive sector of the mineral industry alone accounted for 1.2 percent of 1969 GNP.

Mining and mineral-related manufacturing contributed gross production values of $80 million and $468 million (including raw material cost), respectively, to the economy in 1969. The former was 5 percent and the latter 20 percent above 1968 levels. Production indexes of the major elements of mining and mineral processing follow (1966=100):

Economic sector	1968	1969
Overall mining	103.4	104.8
Coal mining	100.0	92.7
Metal mining	88.7	106.4
Nonmetallics extraction (excluding salt evaporation)	114.8	107.8
Crude petroleum and natural gas production	162.5	207.7
Chemical fertilizers	116.7	126.1
Petroleum refining	134.6	179.8
Coking	99.4	98.5
Overall nonmetallic products	128.1	135.4
Cement and cement products	118.2	127.0
Basic metals	119.0	144.0

The generally favorable economic outlook apparently encouraged the Government to declare intentions of proceeding with several important mineral-processing projects. The most ambitious was an integrated steel plant now scaled at 2 million tons of crude steel per year. Construction of this facility is a major goal of the present development plan. A second petroleum refinery, roughly the same size as the existing 110,000-barrel-per-day plant at Kaohsiung in the south, was to be constructed at Shenao near Keelung in the north. Plans for a major new nitrogenous fertilizer plant, similiar in scale to one completed in 1968 and now producing up to 100,000 tons of urea and 140,000 tons of ammonia sulfate annually, were also announced.

In late 1969 the Asian Development Bank loaned $3.8 million to two Government companies to further integration of the Taiwanese nonferrous metal industries. Most of the $2.7 million assigned to the Taiwan Aluminum Corp. and the $1.1 million allocated to the Taiwan Metal Mining Corp. are for expanding rolling and fabricating facilities. Besides supplying products needed by the country's emerging sophisticated industries, the loans are expected to improve the national trade balance through import substitution and increased export earnings.

Substantial progress was made in 1969

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toward Taiwan's first atomic powerplant. Following recommendations made in March by the U.S. consulting firm, Bechtel Corp., contract awards were granted in October by the Taiwan Power Company to two U.S. companies for the erection of a 600,000-kilowatt light-water reactor. General Electric Co. is to provide the overall design, as well as the steam supply system and the initial fuel element. Westinghouse Electric Corp. is to supply the turbine and generator set. Completion of the plant, to be located at Chinshan in northern Taiwan, is scheduled for 1975. Total costs are presently estimated at $142.7 million, of which $96.1 million is to be in foreign currency. A loan agreement was concluded in November. The Export-Import Bank of the United States will cover $79.7 million of the foreign cost.

PRODUCTION

The gross production of the mineral industry was valued at $548 million in 1969. This figure excluded the increasingly important manufacture of fertilizers, but included, among others, the major coal mining, cement production, petroleum refining, and base-metal processing sectors. Possibly one-fourth of the value can be accounted for by the costs of imported raw materials for the petroleum and metal industries. The 17-percent rise over the corresponding gross value in 1968 was largely the result of greater production of mineral fuels, which increased 21 percent to $259 million. Value of metals output was up 24 percent to $136 million, principally because of a larger production of steel products to meet accelerated demand by both domestic and foreign consumers. Greater production of limestone for the cement industry was probably responsible for the 11 percent increase to $153 million in nonmetallics value.

Quantitative output from petroleum refining, the most important of the fuel-producing sectors, increased 37 percent. The principal factor in the increase was larger demand by powerplants for residual fuel oil. Output of the significant coal sector dropped 7 percent, largely because of production difficulties. The relatively minor crude oil and natural gas sectors posted 38 percent and 27 percent increases in production, respectively. Completion of the new pipelines, processing facilities, and consuming plants was principally responsible for the natural gas rise.

Nitrogenous fertilizer output rose significantly in 1969 because of the completion near yearend 1968 of a major urea and ammonium sulfate plant at Hsinchu.

Table 1.—Taiwan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
METALS				
Aluminum:				
Alumina, gross weight		• 42,000	37,374	44,217
Metal, primary		15,440	20,020	22,108
Copper:				
Mine output, metal content		• 2,300	• 2,300	• 2,300
Metal, refined, secondary		3,001	2,542	2,889
Gold:				
Mine output, metal content	troy ounces	20,574	NA	NA
Metal	do.	35,563	20,994	21,486
Iron and steel:				
Iron ore and concentrate		12,599	• 5,847	7,847
Pig iron	thousand tons	85	76	78
Ferroalloys (ferrosilicon)		1,968	2,189	1,718
Steel ingots and castings	thousand tons	r 228	r 242	271
Silver metal, primary	thousand troy ounces	r 116	r 90	81
NONMETALS				
Asbestos		572	1,200	3,081
Cement	thousand tons	3,487	3,993	4,088
Clays:				
Ceramic and pottery	do.	57	NA	7
Paper filler	do.	4	NA	5
Used in cement	do.	634	NA	755
Brick and tile	do.	830	NA	1,104
Fertilizer materials, manufactured:				
Nitrogenous:				
Gross weight	do.	599	662	729
Nitrogen content	do.	174	189	217
Phosphatic:				
Other than Thomas slag, gross weight	do.	204	204	197
Other, P_2O_5 content	do.	37	37	35

See footnotes at end of table.

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Table 1.—Taiwan: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
NONMETALS—Continued				
Mixed and unspecified, gross weight	do	38	65	121
Gypsum	do	16	6	5
Lime	do	r 121	r 119	110
Pyrite and pyrrhotite (including cupreous):				
Gross weight	do	39	39	38
Sulfur content	do	15	e 14	e 14
Quartz, quartzite and glass sand	do	126	NA	129
Salt, marine	do	517	311	383
Stone, sand and gravel, n.e.s., crushed and broken:				
Dolomite	do	57	79	59
Limestone	do	5,727	6,612	7,406
Sulfur, elemental:				
Native, other than Frasch		6,490	4,432	4,830
Byproduct (recovered from refinery gases)		3,065	NA	NA
Talc and related materials: Soapstone	thousand tons	41	29	24
MINERAL FUELS AND RELATED MATERIALS				
Carbon black		495	NA	NA
Coal, bituminous	thousand tons	5,078	5,014	4,645
Coke:				
Metallurgical	do	188	e 192	189
Gashouse	do	56	r 56	e 56
All other	do	8	e 8	e 8
Total	do	252	256	253
Natural gas [1]	million cubic feet	18,616	24,877	31,553
Petroleum:				
Crude	thousand 42-gallon barrels	246	421	581
Refinery products:				
Gasoline, aviation and motor	do	2,889	3,031	3,811
Jet fuel	do	2,208	r 2,912	3,734
Distillate fuel oil	do	3,039	3,337	5,496
Residual fuel oil	do	r 7,739	11,258	14,875
Liquefied petroleum gas	do	440	677	879
Asphalt and bitumen, refinery	do	626	747	750
Lubricant oils and feedstocks	do	603	681	768
Other, including unspecified	do	406	506	[2] 1,513

e Estimate. r Revised. NA Not available.

[1] Includes unknown amount processed into natural gas liquids by field plants.

[2] Includes 420,000 barrels of naphtha.

TRADE

Trade in the principal mineral commodities rose in 1969 largely because of the worldwide steel boom in which Taiwan participated as both a consumer and supplier. While the expanding domestic economy raised demand for foreign ungalvanized sheets, exports of Taiwanese sheets (both galvanized and ungalvanized), and bars and rods found ready foreign markets. Shipments of cement, the country's second largest mineral export, fell sharply again. In 1969 these were only about half the value of those in 1967 and represented a 7-year low. The foreign exchange cost of petroleum products, the second largest mineral import item, increased only marginally. This was principally the result of lower unit costs of the foreign crude oil, which constitutes the bulk of petroleum imports. Crude imports actually increased almost 7 percent quantitatively. Table 2 shows the major components of Taiwanese mineral trade in 1967–69.

Table 2.—Taiwan: Value of principal mineral export and import commodities

(Million dollars)

Commodity	1967	1968	1969 p
EXPORTS			
Copper ore	$1.7	$1.8	$1.8
Iron and steel products	17.7	r 11.8	21.6
Aluminum products	3.0	2.8	4.1
Cement	18.4	13.9	9.1
Manufactured fertilizers	6.7	3.9	4.3
Petroleum products	5.0	5.7	7.5
Total	52.5	r 39.9	47.9
IMPORTS			
Iron and steel scrap	10.0	9.3	10.2
Iron and steel products	63.4	58.1	77.5
Other metals and alloys	16.1	r 15.3	17.2
Sulfur	10.8	8.6	8.6
Manufactured fertilizers	r 12.1	r 6.3	11.7
Petroleum and products (mostly crude oil)	e 45.0	58.1	59.1
Total	e r 157.4	r 155.7	184.3

e Estimate. p Preliminary. r Revised.

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Table 3.—Taiwan: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum and alloys, all forms		4,552	6,052
Copper, ore and concentrate, including cement copper		15,669	16,452
Iron and steel, metal:			
Pig iron and ferroalloys		5,574	376
Semimanufactures	thousand tons	136	94
NONMETALS			
Cement	thousand tons	1,130	882
Fertilizers, manufactured:			
Nitrogenous	do	68	49
Phosphatic	do	--	7
Other, n.e.s	do	16	2
Salt	do	17	11
MINERAL FUELS AND RELATED MATERIALS			
Coke	thousand tons	8	5
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	87	15
Residual fuel oil	do	--	107
Lubricants and feedstocks	do	349	320
Pitch and asphalt	do	168	176
Other	do	46	--

Source: Chinese Maritime Customs, Statistical Department, Inspectorate General of Customs (Taipei, Taiwan). The Trade of China 1967 (pub. 1968), 863 pp.; 1968 (pub. 1969), 916 pp.

Major destinations of selected commodities, 1968

(Thousand metric tons unless otherwise specified)

Commodity	Quantity
Aluminum and alloys, all forms metric tons	6,052
Japan do	3,380
Copper, ore and concentrate, including cement copper	16
Japan	16
Iron and steel, metal, semimanufactures	94
Thailand	31
Philippines	14
United States	8
Cement	882
South Vietnam	520
Kuwait	97
Fertilizers, manufactured, nitrogenous	49
South Vietnam	49
Petroleum, refinery products, lubricants and feedstocks thousand 42-gallon barrels	320
Japan do	203
Philippines do	52

Major origins of selected commodities, 1968

(Thousand metric tons unless otherwise specified)

Commodity	Quantity
Aluminum and alloys, bauxite, total	55
Brunei	54
Iron and steel, scrap	223
United States	104
Hong Kong	48
Iron and steel, semimanufactures	425
Japan	349
Fertilizers, crude, phosphatic	• 168
Morocco	98
Fertilizers, manufactured, nitrogenous	64
Japan	64
Fertilizers, manufactured, potassic	111
United States	78
Gypsum	85
Australia	53
Mexico	31
Sulfur	66
Canada	25
United States	18
Japan	13
Petroleum, crude thousand 42-gallon barrels	22,820
Iraq do	18,556
Petroleum, refinery products, fuel oil do	4,252
Kuwait do	2,646

• Estimate.

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Table 4.—Taiwan: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum and alloys:			
Bauxite	thousand tons	103	55
Scrap		3,854	4,299
Unwrought and semimanufactures		4,410	5,581
Copper and alloys, all forms		3,618	5,642
Iron and steel:			
Ore and concentrate	thousand tons	68	49
Scrap	do.	218	223
Pig iron and ferroalloys	do.	26	28
Ingots and other primary forms	do.	50	21
Semimanufactures	do.	374	425
Lead and alloys, all forms		5,454	4,139
Manganese dioxide		1,820	1,632
Mercury	76-pound flasks	943	1,408
Nickel and alloys, all forms		152	385
Tin and alloys, all forms	long tons	328	303
Titanium dioxide		2,738	4,136
Zinc and alloys, all forms		10,912	10,797
NONMETALS			
Abrasives		1,427	1,989
Asbestos		2,682	3,772
Fertilizers:			
Crude: Phosphatic	thousand tons	• 155	• 168
Manufactured:			
Nitrogenous	do.	172	64
Potassic	do.	95	111
Graphite		2,002	4,651
Gypsum	thousand tons	62	85
Sulfur	do.	166	66
MINERAL FUELS AND RELATED MATERIALS			
Coal	thousand tons	12	2
Petroleum:			
Crude	thousand 42-gallon barrels	18,250	22,820
Refinery products:			
Fuel oil	do.	858	4,252
Lubricants	do.	202	201
Other	do.	143	97

• Estimate.

Source: Chinese Maritime Customs, Statistical Department, Inspectorate General of Customs (Taipei, Taiwan). The Trade of China 1967 (pub. 1968), 863 pp.; 1968 (pub. 1969), 916 pp.

COMMODITY REVIEW

METALS

Aluminum.—During 1969 the Taiwan Aluminum Corp. (TALCO), the country's Government-owned aluminum-producing concern, considerably amplified its present expansion program. In addition to the planned increases of its 42,000-ton-per-year alumina facility to 76,000 tons by October 1970 and its 20,000-ton-per-year primary aluminum installation to 38,000 tons by 1971, TALCO now plans with foreign aid to raise the capacity of a recently installed cold-strip mill to 5,000 tons annually; to construct a 2,000-ton-per-year aluminum alloy rod and wire mill; to build an interrelated superpurity refinery and foil-manufacturing plant producing 200 tons annually of foil and 350 tons of strip and wires; and to establish a fabricating plant for aluminum containers. Financial and technical assistance from French, German, Japanese, and U.S. sources has been arranged. Malaysian bauxite was the principal raw materials for TALCO's 1969 operations.

Copper.—Chinkuashih mines of the Government-owned Taiwan Metal Mining Corp. (TMMIC) continued to account for over 90 percent of the mine copper produced. All Chinkuashih output, which included copper concentrate and cement copper in a 2-to-1 ratio (in terms of metal content), was shipped to Japan for processing and return. TMMIC's existing mine smelter also provided over 90 percent of the country's small output of electrolytically produced copper metal, all of which was derived from scrap. Construction was initiated at Chinkuashih on a small, new smelter to produce a 44-percent-grade

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copper matte by mid-1970; this will be sent to Japan for further treatment until appropriate refining facilities can be built. TMMIC also made arrangements during the year to erect, with foreign financial and technical assistance, a modest fabrication plant to produce annually 200 tons of copper strip, 400 tons of brass strip, and 1,200 tons of copper wire. If all plans are completed, TMMIC will join TALCO as an integrated nonferrous metal producer.

Copper exploration in eastern Taiwan centered in 1969 on the Chimei area near Haulien. Geophysical and geochemical investigation has suggested the presence of sizable tonnages of porphyry copper in more than one location. Test drilling was underway at yearend to prove up reserves. Various international mining companies expressed interest in the development of the Chimei copper deposits.

Iron and Steel.—Plans for the establishment of a conventional integrated steel plant were reviewed near yearend, following completion of a feasibility study by Australian experts. A 2-million-ton-per-year plant is to be built over the next 5 years. Details on this much-discussed, altered, and postponed project have not yet been ascertained.

Two-thirds of Taiwan's steel demand continued to be met principally from about 35 small electric-arc furnaces with a capacity of about 200,000 to 250,000 tons annually. Additional steelmaking facilities added approximately another 100,000 tons of capacity. Rolling (including rerolling) capacity totaled approximately 300,000 tons; about 60 rolling units were in existence, including four wire-rod mills. The Taiwan Iron Manufacturing Co. was by far the largest of the approximately 15 iron producers.

NONMETALS

Cement.—Decreasing exports and a slower production growth aimed principally at meeting domestic demand characterized the cement industry in 1969. The capacity of Taiwan Cement Corp.'s (TCC) Suao plant on the northeastern coast was virtually doubled to 530,000 tons annually with the addition of a fourth kiln. This raised the total capacity of TCC's four plants to 2.2 million tons, about 40 percent of the national capacity. Asia Cement Corp., with its only plant at Hsinchu, ranked next to TCC; a fourth kiln was being installed as part of the program to raise annual capacity to 1.7 million tons in 1970.

Fertilizers.—The principal new facility added in 1969 was a 45,000-ton-per-year mixed-fertilizer unit at Kaohsiung. Construction reportedly was also started on a second unit at this plant, which is owned by the Government's Taiwan Fertilizer Co. (TFC). At yearend Taiwan had a total annual fertilizer production capacity of about 1.2 million tons divided among 6 companies and 13 plants. TFC, however, owned eight of the plants and accounted for 62 percent of production capability. Annual production capacity by kind of fertilizer (with TFC's portion in parentheses) is as follows:

	Thousand metric tons	
Ammonium sulfate	480	(240)
Urea	290	(170)
Calcium superphosphate	210	(180)
Nitrochalk	70	(70)
Ammonium phosphate	25	(25)
Mixed fertilizers	110	(50)

MINERAL FUELS

Coal.—Production fell significantly in 1969. This is attributed to a shortage of workers; to delays (caused mainly by financial distress) in announced plans to consolidate the approximately 300 existing small, inefficient mines into fewer, larger, more effective units and to open some 13 new modern pits; and to the increasingly non-competitive prices of coal. Not only was output far below the 5.75-million-ton target set for the year, but it dropped beneath the 5-million-ton level for the first time since 1963. Difficulty in obtaining enough fuel to keep coal-burning powerplants operating smoothly reportedly was the principal factor behind Taiwan Power Company's import of about 200,000 tons of Australian coal in 1969 as an emergency reserve.

Some 37 workers were killed and 47 others injured on July 7 in a coal dust explosion at a mine northeast of Taipei. Allegedly, it was the country's worst mining disaster in recent years.

Natural Gas.—Development of natural gas continued in 1969, with the efficient utilization of rather limited resources. A phased construction schedule was being drawn up for laying by 1972 about 150 miles of 16-inch pipe. The pipeline is to

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extend from the producing Hsinchu and Tiehchenshan fields of northwestern Taiwan, already connected to Taipei in the north by about 65 miles of line, to Kaohsiung in the south. At Tiehchenshan a natural-gas processing plant was completed. It is capable of treating a slightly over 100 million cubic feet daily of natural gas and extracting up to 300,000 barrels annually of gasoline, as well as substantial amounts of liquefied petroleum gas and ethane. Near the existing gasfields at Miaoli, construction on Chang Chun Petrochemical Co., Ltd.'s 150-ton-per-day methanol plant was moving toward completion in 1970. Further investigation of the new and apparently promising Chiting and Chingtsaohu fields, also located in the northwest, was continuing. The deepest well ever drilled in Taiwan, however, was the apparently unsuccessful wildcat drilled in March to 18,000 feet at Pakuashan in the northwest.

Petroleum.—Although output of indigenous crude oil increased 38 percent in 1969, production was still a mere fraction of domestic consumption. Civilian demand for products, including bunkers, was projected in late 1969 to reach 24.1 million barrels by yearend, 30 percent more than the previous year. Most of the overall increase was to be accounted for by a sharp rise in the use of residual fuel oil by powerplants. Consumption of about 16.5 million barrels of residual fuel oil, 3.4 million barrels of distillate fuel oil, 2.6 million barrels of gasoline, and 1.6 million barrels of other products was projected. Industry was expected to use 63 percent (mostly residual fuel oil); transportation, 26 percent (largely gasoline and distillate fuel oil); fishing fleets, 8 percent; and residential and commercial heating and lighting, the other 3 percent.

Government efforts to lower cost of imported crude oil continued throughout the year. To reduce use of the comparatively expensive small charter tankers now bringing in foreign crude, the Chinese Petroleum Corp. ordered four 100,000-deadweight-ton tankers. One of these was reportedly completed in early 1969. Offshore unloading facilities, capable of receiving tankers up to 100,000 tons, reportedly were completed off Kaohsiung, where the present refinery is located. At Shenao in the north, where a new refinery is to be built, offshore discharging facilities to handle 150,000-ton tankers were being planned.

During the year, the Government became concerned about offshore oil legislation in view of potential resources in the East China Sea.

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The Mineral Industry of Thailand[1]

By A. F. Grube[2] and K. P. Wang[3]

Thailand's mineral industry recorded a moderate growth in output value in 1969, chiefly as a result of higher tin prices in the latter part of the year rather than because of notable increases in volume of output. The higher value of mineral industry output was an element in the overall continued upturn in the national economy, reflected in preliminary figures for the gross national product equivalent to $5,929 million (current prices) for 1969, compared with $5,575 million for 1968.

At yearend, the Parliament of Thailand was considering a proposed petroleum law drafted by the Juridical Committee and approved by the Thai Cabinet. Six large oil companies, five United States and one British company, were conducting surveys in the Gulf of Thailand on the basis of preliminary awards and provisional legislation.

In January 1970 Thailand was granted a World Bank loan amounting to $46.5 million to be used for expanding the country's thermoelectric and hydroelectric power generating capacity. Capacity will be increased by 560 megawatts. The total cost of the expansion program will be equivalent to $92.4 million, with the Thailand Electricity Generating Authority providing the remaining funds. This is the World Bank's fifth loan for electric power in Thailand. Consumption of electric power in 1969 was considerably higher than the 2,540 million kilowatt-hours consumed in 1968. In the field of nuclear power, Chonburi Province was chosen as the site for Thailand's first atomic powerplant. According to the Electricity Generating Authority, construction of the $125 million plant would begin in 1971 for completion in 1977.

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[1] Based to a significant extent on information from the Thailand Department of Mineral Resources. The Mining Industry of Thailand. November 1969, Bangkok, pp. 1–80.

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PRODUCTION

Thailand maintained its position as the free world's third largest tin producer, with metal output down about 11 percent from that of 1968. The value in 1969, however, was considerably greater than a year earlier, because of much higher average tin prices. Thai tin accounted for more than half the country's total mineral production value, excluding manufactured cement and refined petroleum. Fluorspar and iron ore were next in importance.

Comparing Thailand's leading mineral products in terms of tonnages for 1968 and 1969, cement showed little change, petroleum products and fluorspar increased more than a fifth, iron ore declined slightly and mine tin output fell by 12 percent. Higher prices in some lesser metals, such as tungsten and antimony, created more interest in their exploration and extraction. Manganese output continued to decline, because of reduced Japanese purchases.

TRADE

Tin exports, valued at $73 million during 1968, continued as Thailand's most important mineral commodity export, with the value reaching $79.6 million in 1969.

Exports of cut and uncut precious and semiprecious stones (exclusive of diamonds) valued at $6.6 million ranked second to tin among mineral commodity exports; this

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Table I.—Thailand: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Antimony:			
Ore	2,280	423	1,560
Mine output, metal content e	1,026	202	750
Metal	129	380	246
Chromite	210	-------	-------
Columbite	46	40	26
Iron and steel:			
Iron ore, 55 percent iron thousand tons	549	500	477
Pig iron do	6	17	11
Steel ingots and castings do	3	5	4
Lead, mine	3,477	2,720	1,900
Manganese:			
Battery grade, 75 percent manganese dioxide	9,145	5,855	4,226
Metallurgical grade, 46 to 50 percent manganese dioxide	69,420	35,218	25,595
Chemical grade, 75 percent or more manganese dioxide	-------	-------	115
Rare-earth minerals, monazite	-------	40	65
Tin:			
Tin-in-concentrate long tons	22,490	23,678	20,786
Metal do	26,634	24,662	22,049
Tungsten concentrate, 65 percent tungsten trioxide	839	965	1,267
Zinc, mine (in lead-zinc ore) e	1,400	1,100	700
Zircon	1,530	3,220	250
NONMETALS			
Barite	224	-------	-------
Cement thousand tons	1,737	2,365	2,403
Fluorspar, 80 to 85 percent calcium fluoride	133,152	245,107	297,560
Gypsum	61,696	128,094	92,034
Marl (used for cement) thousand tons	1,214	1,624	1,534
Salt, sea, 85 to 90 percent sodium chloride e thousand tons	110	150	200
Sulfur, elemental, byproduct (recovered)	NA	6,693	798
Talc and related materials, pyrophyllite	13	3,363	1,982
MINERAL FUELS AND RELATED MATERIALS			
Coal, lignite e thousand tons	335	305	348
Petroleum:			
Crude thousand 42-gallon barrels	14	26	16
Refinery products:			
Gasoline and naphthas do	3,214	3,857	4,880
Kerosine do	562	992	NA
Jet fuel do	1,364	1,197	1,591
Distillate fuel oil do	4,987	5,405	6,471
Residual fuel oil do	3,910	5,127	6,375
Lubricating oil do	47	63	e 70
Asphalt do	767	r 756	747
Liquefied petroleum gas do	147	r 408	598
Other do	-------	-------	-------
Total do	14,998	17,305	NA

e Estimate. p Preliminary. r Revised. NA Not available.

Table 2.—Thailand: Exports and reexports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Antimony ore and concentrate	2,778	1,102	West Germany 821; Japan 197.
Iron ore thousand tons	496	402	All to Japan.
Lead ore and concentrate	9,183	7,755	Netherlands 6,275; West Germany 1,200.
Manganese ore and concentrate	80,353	45,006	Japan 40,390; Taiwan 3,310.
Tin metal long tons	26,572	23,638	United States 11,855; Netherlands 8,770.
Tungsten ore and concentrate	888	819	Japan 446; United Kingdom 190; Netherlands 92.
NONMETALS			
Cement	33,817	34,709	Laos 34,545; Burma 144.
Feldspar, leucite, nepheline, fluorspar, and syenite	125,752	204,871	Japan 199,303; United States 3,700.
Precious and semiprecious stones, except diamonds thousand carats	11,107	5,456	Hong Kong 1,319; Switzerland 975; West Germany 661.
Salt thousand tons	88	108	Malaysia 57; Japan 25; Singapore 21.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum, crude oil (reexports) thousand 42-gallon barrels	119	-------	
Petroleum refinery products do	1,331	272	Taiwan 113; Laos 88; Singapore 55.
Bunkers do	169	346	

Source: Thailand Department of Customs.

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was due primarily to significantly increased exports of sapphires. It is to be noted, however, that Thailand imports large quantities of uncut stones for cutting and reexporting. During 1968, for example, Thailand imported uncut sapphires amounting to 19,413,734 carats and exported cut sapphires amounting to 2,007,649 carats.

Other significant exports by value included feldspar, leucite, nepheline, fluorspar, and syenite, $5.6 million; iron ore and concentrates, $2.5 million; and tungsten ore and concentrates, $2.1 million. Thai fluorspar, predominantly exported to Japan, became most important in world trade of that commodity, with the country ranking second or third among exporting countries.

Iron and steel, all forms, valued at $88.4 million, were Thailand's most important mineral commodity imports during 1968. Imports of crude oil, valued at $47.8 million and refined petroleum products valued at $47.3 million occupied second and third place. The only other significant mineral commodity imports by value were aluminum, all forms, $6.7 million; copper, all forms, $5.9 million, and zinc, all forms, $5.1 million.

Table 3.—Thailand: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum and alloys:			
Unwrought	4,571	5,231	United States 3,571; Canada 1,189.
Semimanufactures	3,533	3,580	Japan 1,927; West Germany 345.
Copper and alloys:			
Unwrought	370	223	Australia 152; New Zealand 50.
Semimanufactures	5,185	5,256	Japan 4,008; United States 470.
Iron and steel:			
Scrap	25,110	75,105	United States 42,986; Belgium 14,079.
Ferroalloys	2,332	3,487	Republic of South Africa 1,413; Japan 976.
Semimanufactures	657,359	647,077	Japan 433,833; Hong Kong 62,954.
Lead and alloys:			
Unwrought	1,667	2,932	Australia 2,560; Japan 260.
Semimanufactures	76	256	United States 141; Japan 55.
Mercury	17	256	United Kingdom 211; Japan 39.
Nickel, all forms	230	248	West Germany 122; Japan 94.
Silver and alloys, all forms	168	54	India 48; Japan 3.
Zinc and alloys:			
Unwrought	16,650	14,646	Australia 9,374; Japan 2,695.
Semimanufactures	2,208	2,138	Poland 1,055; Australia 305.
NONMETALS			
Asbestos, crude	24,107	19,534	Republic of South Africa 12,433; Canada 6,773.
Cement	312,286	107,365	Japan 64,222; Taiwan 31,300; Malaysia 11,004.
Clays and refractories:			
Crude clay, n.e.s.	4,203	9,391	India 3,277; United States 3,026.
Clay construction materials:			
Refractory	11,273	11,730	Japan 6,675; Taiwan 1,396.
Nonrefractory	11,470	11,571	Japan 6,658; West Germany 2,200.
Diamonds:			
Industrial carats	708	101	Republic of South Africa 96; United Kingdom 5.
Gem, cut and uncut do.	4,463	42,693	Republic of South Africa 11,203; United Kingdom 9,219; Netherlands 8,300.
Fertilizer materials, manufactured:			
Nitrogenous	57,485	46,577	West Germany 15,599; Japan 14,309; United States 6,823.
Phosphatic	88,870	134,293	Japan 80,119; Italy 17,000; United States 13,365.
Potassic	3,259	3,858	United States 1,505; West Germany 800.
Mixed	67,897	80,760	West Germany 31,376; Japan 15,106; Malaysia 10, 175.
Ammonia, anhydrous	429	538	Japan 334; Indonesia 83.
Graphite	860	1,021	Japan 665; South Korea 164.
Precious and semiprecious stones except diamonds thousand carats	18,145	28,662	West Germany 6,475; Switzerland 4,577; France 4,144.
Sulfur (elemental)	15,955	14,849	Poland 7,879; United States 2,554; West Germany 1,728.
Talc, soapstone, and steatite	2,056	2,162	South Korea 1,610; Japan 303.
MINERAL FUELS AND RELATED MATERIALS			
Coke	5,991	10,770	United States 6,889; Japan 2,610.
Carbon black	3,557	5,026	United States 2,373; Australia 1,229.
Liquefied petroleum gas thousand 42-gallon barrels	50	91	Singapore 56; Indonesia 23; Japan 7.

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Table 3.—Thailand: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	Principal sources, 1968
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum:				
Crude	do	16,034	20,238	Persian Gulf countries 9,893; Saudi Arabia 5,509; Iraq 1,681.
Unfinished oils	do	-------	1,596	United Kingdom 669; Kuwait 271; Iraq 153.
Refinery products:				
Gasoline	do	1,362	1,209	Iran 386; Indonesia 228; India 191.
Kerosine	do	305	252	Iran 90; Malaysia 53; Indonesia 26.
Jet fuel	do	r 592	702	Saudi Arabia 331; Iran 230; Bahrain 91.
Distillate fuel oil	do	4,462	7,898	Iran 3,838; Saudi Arabia 1,779; Kuwait 946.
Residual fuel oil	do	1,442	1,307	Indonesia 1,096; Singapore 144; Iran 48.
Lubricating oil	do	582	617	Singapore 280; United States 214; Japan 61.
Asphalt	do	34	380	Japan 153; Singapore 96; Iran 43.
Petrolatum and wax	do	39	41	Indonesia 20; United States 7; Japan 6.
Other	do	r 165	136	Singapore 58; Indonesia 23; Japan 17.
Total	do	8,983	12,542	

r Revised.

Source: Thailand Department of Customs.

COMMODITY REVIEW

METALS

Aluminum.—Alcan Aluminium, Ltd., of Canada announced that an agreement was signed with P. Piya Co., Ltd., to form a new aluminum venture called Alcan Thai Co., Ltd. Each party holds half interest, and Piya's assets of a 1,650-ton aluminum extrusion press and anodizing facilities will be turned over to the new management. Thailand has been importing about 10,000 tons of aluminum ingot and semimanufactures annually, about half of each type.

Antimony.—Thailand's antimony industry, comprised of small mines scattered around the country, was producing at an annual level of about 1,000 tons of antimony-in-ores and up to a few hundred tons of metal until 1968 when many operations were shut down, including the largest mine in Surat in the south. As a result of the many-fold increase in world antimony prices beginning in late 1969, exploration became active again, particularly in northern Thailand, and some of the abandoned mines there and elsewhere have resumed small-scale operations. Miners in Thailand, however, consider stibnite mining a rather risky business.

Copper.—There were indications that Thailand might soon join the ranks of the world's copper producers. A consortium comprised of Signal Oil Co. and Dillingham Corp. performed extensive investigation work including diamond drilling of copper deposits located at Loei in northern Thailand, where reserves may be on the order of 80 million tons of 0.7-percent copper ore. The concession rights to this area were originally granted to Mr. Suwan Viraphol who in turn made arrangements for Signal and Dillingham to conduct exploratory operations under a partnership arrangement. Mining rights for two deposits in the area were granted to a joint venture company including Mr. Viraphol and the U.S. firms.

It was reported that the Japanese firms Sumitomo Electric Industries, Ltd., in collaboration with Mitsui and Co., Ltd. planned to establish the Siam Electric Industry Co. at Bangkok for the purpose of manufacturing sheathed copper cable and wire. Raw material requirements will be imported from Japan.

Gold.—The Thailand Cabinet has taken steps to revoke the law reserving to the Crown the right to explore for gold. In anticipation of the law's revocation, 13 firms have applied for concessions in the provinces of Petchabun, Udon Thani, Lop Buri, Prachin Buri, Loei, Nong Khai, Chachoengsao, Chantaburi, Chon Buri, Nakon Sawan, Prachvab Khiri Kan, Sukhothai, Chang Mai, and Chiang Rai.[4]

[4] The Investor (Bankok). V. 1, No. 10, September 1969, p. 751.

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Iron Ore.—Although iron occurs in many parts of the country, no deposit of significant economic consequence has as yet been discovered. Most of the roughly half million tons of iron ore produced annually in Thailand during recent years has come from Nakhon Si Thammarat in the south. The bulk of the output has gone to Japan, since the Thai steel industry, which is capable of producing a few hundred thousand tons of steel products annually, starts from scrap, pig iron, steel ingots, and semimanufactures rather than iron ore.

Iron and Steel.—In April 1969 the International Finance Corporation made an investment of $22.1 million in the Siam Cement group of companies. A portion of these funds was to be used to enlarge the facilities of Siam Iron and Steel Co. Ltd., owned by the Siam Cement group. The company plans to build a 150,000-ton-per-year rolling mill with an arc furnace and continuous casting machine. Additionally, the steel foundry's capacity will be increased by 1,500 tons per year, the grinding ball-making capacity by 1,000 tons per year, and the output of the refractory plant to 17,000 tons of bricks and shapes and 8,000 tons of ramming mass per year. Construction of a malleable iron foundry with a 2,000-ton-per-year capacity for the manufacture of pipe fittings is also planned.

During 1969 an agreement was reached between the Thai company, Iron and Steel Bars Industrial Corp., and Indian businessmen for the building of a 50,000-ton-per-year rolling mill. The rolling mill, to be built in India, is expected to be delivered to Thailand by May 1970 with trial production scheduled to start by mid-August 1970. A new company, Thai India Steel Co., has been formed and will take over Iron and Steel Bars Industrial Corp.'s assets.

Plans for the construction of an integrated steel mill to supply the entire Southeast Asia area with all its steel requirements made no further headway during the year. The plan envisioned a jointly owned complex consisting of Singapore blast furnaces and Thai rolling mills. According to the Japanese,[5] a plan submitted by the U.S. firm Koppers Co., Ltd., was not realistic. Instead, they suggested that a joint venture steelworks be built somewhere south of Bangkok for Thailand alone with 40 percent Japanese financing. The first step would be to build a 200,000-ton-per-year cold tandem mill, followed eventually by blast furnaces, converters, and other facilities with a combined annual capacity of 1 million tons.

Lead and Zinc.—Thailand's lead-zinc deposits occur mostly near the Thai-Burma border. Kanchanaburi has been the only lead-producing Province in recent years, furnishing about 3,000 tons of lead-in-concentrates annually. The Mae Sod zinc deposits, with reserves of several million tons of very high grade nonsulfide ore in the form of smithsonite and calamine, were investigated by National Lead Co., but this U.S. firm decided not to develop the property for the time being.

Manganese.—Thailand produced manganese of various types from the Provinces of Lamphun, Songkhla, Yala, and Chiang Mai. The battery-grade manganese finds a local market in making dry cells. The bulk, however, relied on the Japanese market. Overall Thai output of manganese ore, mostly metallurgical grade, has declined sharply, because of dwindling Japanese purchases, which dropped from 68,000 tons in 1967 to 34,000 tons in 1968 and less than 10,000 tons in 1969.

Tin.—The International Tin Council continued its controls over tin exports during all of 1969. Thailand's export quota for the year was set at 23,300 long tons, and Thai sources claimed that shipments could have been higher even under the advanced prices were it not for the quota. Due to improved world tin prices, the International Tin Council indicated that export limitations would not be imposed, at least during the first quarter of 1970.

Offshore exploration for tin continued throughout 1969. A large and apparently rich deposit was found in the Andaman Sea off the western coast of Phuket Island, Thailand's chief tin-producing area. The deposit reportedly is in water considerably deeper than that to which most dredge operators are accustomed. However, Southern Kinta Consolidated Ltd.'s dredge, the Takuapa, operated at this site on an experimental basis in 1969.[6] If results from this activity with Thailand's only operating suc-

[5] Japan Metal Bulletin (Sangyo Press, Osaka). Mar. 24, 1970, p. 2.
[6] International Tin Council. Tin International. V. 42, October 1969, p. 280.

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tion dredge prove economic, a large new tin source could be developed in 1970–71.

Another firm engaged in offshore work, the Thai-U.S. firm Thailand Exploration and Mining Co., has ordered a suction cutter dredge with a monthly capacity of 400,000 metric yards from the Japanese Mitsui Shipbuilding and Engineering Co., Ltd. The dredge is expected to be operating in Thailand by late 1971 and will be the world's largest.

Two of Japan's large trading firms, Mitsui and Co., Ltd. and Mitsubishi Trading Co., Ltd. were considering the construction of two separate tinplating facilities in Thailand. Mitsui, in cooperation with Tin Plate Products Co. of Thailand, is considering the construction of an electrolytic tin line with an annual capacity of 50,000 tons. Mitsubishi Trading in partnership with Pineapple Corp. of Thailand is considering construction of facilities capable of producing 50,000 tons of tinplate per year.

Thailand produced and exported less tin than in 1968, but the 1969 value reached nearly $80 million which was considerably higher than the 1968 value. Thailand Smelting & Refining Co., Ltd. (Thaisarco), joint venture with the U.S. firm Union Carbide Corp., continued to smelt all of Thailand's tin concentrate.

Tungsten.—Thailand's tungsten concentrate is primarily a byproduct of tin mining. About a third of the national output of more than 1,000 metric tons of concentrate in 1969 came from the central region of Kanchanaburi, followed by Nakhon Si Thammarat in the south as the next largest producing district. Very high tungsten prices towards yearend no doubt would stimulate Thai production further.

Other Metals.—A new zircon beach sand operation started production during 1969, in the Gulf of Siam near Kooy and Prachuab, southwest of Bangkok. A report was submitted at the International Technical Tin Conference held in Bangkok during November on the byproducts of the Thaisarco tin smelter on Phuket; several hundred tons of high columbite content slag (up to 21 percent columbite-tantalite in grade) have been produced from this smelter annually during recent years.

NONMETALS

Barite.—Through yearend 1969, there were no indications of the development of a local market for barite, an event that had been hoped for in Thai circles during 1967–68, and output, if any, was unreported. However, the prospect of offshore oil exploratory drilling in 1970 might provide the necessary stimulus. At yearend 1969, the status of a planned joint Thai-U.S. consortium for barite mining and grinding was unreported. Earlier, this group had applied to the Thailand Board of Investment for promotional privileges for the planned construction of a mill to produce ground barite for use as a weighting agent in oil and gas-well drilling muds. Formation of a new company under the name of Barite Thailand Co., Ltd., was proposed, with the Thai firm, Huey Yai Mining Company, Ltd., holding a 51-percent interest and the balance being held by the Baroid division of the National Lead Co. and Paul F. Scholla & Associates. The $1 million mill was to be built in the southern Province of Songkhla where there are large reserves of high-grade barite. Recent exploration located additional reserves of barite in Yala and Nakhon Si Thammarat Provinces.

Cement.—If current construction plans materialize, the production capacity of Thailand's cement manufactures will be more than doubled by 1972. Siam Cement Co., Ltd., with the aid of an International Finance Corporation loan, is building a new plant in the northeast with a clinker capacity of 1,500 tons per day; Jalaprathan Cement Co. Ltd. has contracted with the Japanese firm Ishikawajima-Harima Heavy Industries Co., Ltd., for the construction of a 1,500-ton-per-day dry process cement plant to be located at Cha-am, a suburb of Bangkok; Siam City Cement Co., owned by Thais, reportedly has let a contract for the construction of a new plant at Tabkwang in Saraburi Province with a capacity of 500,000 tons of cement annually; and a Thai-Japanese group envisions building a 500,000-ton-annual-capacity plant at Prakanon outside Bangkok.

The Siam Cement group, in addition to being Thailand's major producer of cement (current capacity 2,300,000 long tons per year), also is an important source for other construction materials required by the building industry. An affiliate company, Siam-Fibre Cement Co., Ltd., produces a variety of asbestos cement products. Upon completion of a third plant, currently under construction, this company's annual

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production capacity in asbestos cement products will be 265,000 tons of roofing materials, 125,000 tons of flatsheets and siding, and 45,000 tons of high-pressure and low-pressure asbestos cement pipes. Another affiliate of the Siam Cement group, Concrete Products and Aggregate Co. Ltd., has an annual production capacity of 40,000 cubic meters of prestressed concrete in the form of piles, bridge girders, beams, and telephone poles; 13,000 cubic meters of footings and slabs, ordinary and reinforced concrete pipe; 4,000,000 concrete blocks; 500,000 cubic meters of ready-mixed concrete; and 450,000 tons of crushed rock.

Fertilizer Materials.—The Japanese Mitsui group of companies plans to build a fertilizer complex in Thailand subject to the approval of the Thai Government. A plan is under consideration for a joint venture between Iran's National Petrochemical Co. and Thai interests. Iran proposes to ship petrochemical feedstocks to Thailand for the conversion into fertilizers.

Thailand's only chemical fertilizer plant at Mae Moh is currently operating at about 70 percent of its rated capacity—27,000 tons of nitrogen fertilizer per year. The plant is owned by Chemical Fertilizer Co. Ltd. Domestic demand for nitrogen-type fertilizers has been less than anticipated, and future plants will undoubtedly concentrate on the manufacture of mixed fertilizers.

Fluorspar.—Thai fluorspar has attained great world prominence in only a few years' time, and production is still rising. Output in 1969 totaled nearly 298,000 tons, and Japan, the main purchaser and consumer, imported 254,610 tons of Thai fluorspar during the year, as compared with 193,364 tons in 1968. Most output comes from the north, headed by the Lamphun district near Chiangmai. Universal Mining Co. provided roughly two-fifths of Thai fluorspar from the Ban Hong and Mae Tha mines, both in Lamphun. Thai Fluorspar and Minerals Co., with a mine also in Ban Hong, produced in excess of 3,000 tons monthly. At least four other companies mined more than 1,000 tons monthly, including Thep-Nithi Co., whose head, Mr. Thuan, was also the president of the Thai Fluorspar Association. The sudden growth of this industry prompted the Department of Mineral Resources to organize two fluorspar conferences, the second one in July 1969. National reserves, scattered around the "tin-barren granite" areas of Thailand, were estimated at a minimum of 10 million tons recoverable fluorspar. Present simple mining and handsorting methods are wasteful, and at yearend efforts were underway to increase ore dressing capacity and to open new markets in Australia, India, and Taiwan.

Gem Stones [7].—Thailand is becoming one of the world's most important centers for cutting gems other than diamond. Thailand not only cuts stones produced domestically but also cuts stones imported from nearby countries. It is estimated that 90 percent of the stones now being cut in Thailand are imported and as much as 90 percent of Australia's total production of blue sapphires is sent to Thailand for cutting. Because of its more competitive prices and the wide variety of stones available, Thailand's importance in world gem trade is growing as evidenced by the country's increasing imports and exports.

Gypsum.—Gypsum has been produced from Nakhon Sawan in the north, Surat in the south, and Phichit in the north, mainly by Thai Gypsum Co., Ltd. Output from the north has gone to domestic cement factories, and that from the south has been exported to Malaysia. Resources are extensive, but marketing is difficult because of the expensive shipping cost to consuming plants and ports. Production, however, can be greatly increased as need arises.

MINERAL FUELS

Lignite.—Thailand's lignite production has been 300,000 to 400,000 tons annually in recent years from Krabi in the south and Mae Moh in the north. Krabi's output goes entirely to the local power station, whereas Mae Moh's output is consumed for both power generation and fertilizer manufacture near the mine. The former Lignite Authority, which controlled production, became a part of the newly created Electricity Generating Authority.

Petroleum.—During 1969 six countries that had secured exploration rights to acreage in the Gulf of Thailand in 1967 completed first-stage seismic work which they were in the process of evaluating. None, however, had commenced exploratory drilling. The companies are perhaps reluctant to invest additional funds in exploratory

[7] The Investor (Bankok). V. 1, No. 12, November 1969, pp. 901-913.

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work because the Thai Government has yet to enact legislation governing exploitation of the country's petroleum resources.

During the year Continental Oil Co., one of the companies which had been granted an exploration concession for an offshore acreage in the Gulf of Thailand, proposed that the Mitsui group of Japan join them in this venture. If the negotiations are successfully concluded, it will give the Japanese another potential overseas oil source and will possibly enable Continental to enter the Japanese petroleum market. Another exploration concession holder, Tenneco Oil, Inc., acquired three partners during the year for the development of its acreage. The companies joining Tenneco are the U.S. firms Marathon Oil Co. and Phillips Petroleum Co. and the Italian firm Ente Nazionale Idrocarburi (ENI). Tenneco and Marathon will each have a 33-⅓-percent interest; Phillips will have a 23-⅓-percent interest and ENI 10 percent.

The Thai Cabinet in mid-1969 approved an application of the Summit Industrial (Panama) Co., Ltd., for a 10 year extension of their lease to the Thai Defense Ministry's refinery located in the Bang Chak district of Bangkok. The company applied for this extension in order to expand the refinery's capacity from 20,000 to 65,000 barrels per day. Summit first leased the refinery from the Defense Energy Department in 1965 for 15 years. Since then the company has increased the capacity of the refinery from 5,000 barrels per day to 20,000 barrels per day. The equipment necessary for the current planned expansion is to be provided by the Japanese Mitsui group in cooperation with Toyo Engineering Corp.

Virtually all of Thailand's oil requirements have been met by imports. Even in 1968, the country imported roughly 33 million barrels valued at about $95 million, nearly two-thirds of which was crude oil. Although later statistics are not available, the trend is clearly upwards.

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The Mineral Industry of Tunisia

By Eugene R. Slatick [1]

Late in the year the operations of several mineral industries, particularly phosphate rock mining, were disrupted by the worst floods in Tunisia's recorded history. The floods, caused by torrential rains in late September and early October, washed out roads and railroads. Exports of several minerals were stopped for over a month until the transportation arteries were rebuilt.

Earlier in the year the World Bank and its affiliate, the International Development Association, approved a $17 million [2] loan to modernize Tunisia's railroads, which are important to the country's mineral industry. Other foreign assistance received during the year included credits from France to build a phosphoric acid plant and wire drawing plant and to develop a lead mine; a loan from Canada to purchase fertilizer; and a loan from Spain to purchase a petroleum tanker.

During the year, the Government announced a 4-year plan covering 1969–72. Gross investment envisaged during the period will total about $1,175 million. The mineral industry's share of the total is about $180 million, mostly for developing fertilizer materials and petroleum resources.

To encourage private investment in the country, the Government also promulgated an investment code. New investors will receive various tax benefits and guarantees of repatriation of profits and capital. Investors will still be required to negotiate agreements individually with the Government.

In September Tunisia became an associate member in the European Economic Community (Common Market). The association enables Tunisian industrial products to enter the Common Market free of duties and quotas. However, for refined petroleum products, a duty-free quota was fixed at 100,000 tons per year (700,000 to 900,000 barrels).

PRODUCTION AND TRADE

The available data for mineral production and trade are listed in the following tables:

[1] Foreign mineral specialist (petroleum), Bureau of Mines, Washington, D.C.

[2] Where necessary, values have been converted from Tunisian dinars (TD) to U.S. dollars at the rate of TD1 = US$1.905.

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Table 1.—Tunisia: Production of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Iron and steel:			
Iron ore and concentrate—thousand tons	918	1,016	e 1,000
Pig iron—do	98	128	e 120
Steel ingots and castings—do	e 45	80	e 80
Steel semimanufactures—do	e 50	80	e 80
Lead:			
Mine output, metal content	12,447	14,708	e 15,000
Metal:			
Primary	13,245	14,024	e 14,000
Antimonial	355		
Mercury, metal, primary—76-pound flasks	292	309	e 320
Silver, metal, primary—troy ounces	44,722	e 46,000	e 47,000
Zinc, mine output, metal content	4,152	5,148	e 5,300
NONMETALS			
Cement, hydraulic—thousand tons	472	e 470	e 376
Clays, construction—do	220	e 250	e 260
Fertilizer materials:			
Crude (natural), phosphate rock—do	2,886	3,444	p 3,200
Manufactured:			
Hyperphosphate—do	6	15	e 10
Superphosphate—do	31	35	e 30
Triple superphosphate—do	324	376	e 360
Fluorspar, all grades	1,700	5,450	NA
Gypsum and anhydrite, crude—thousand tons	e 10	e 10	NA
Lime, hydraulic—do	170	e 170	NA
Salt, marine—do	241	360	e 350
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural, marketed—million cubic feet	328	338	e 350
Petroleum:			
Crude oil—thousand 42-gallon barrels	17,068	r 24,539	25,394
Refinery products:			
Gasoline and naphtha—do	1,258	1,867	e 2,100
Kerosine—do	434	428	e 500
Distillate fuel oil—do	1,832	2,318	e 2,500
Residual fuel oil—do	2,239	2,501	e 2,800
Liquefied petroleum gas—do	172	245	e 300
Total—do	[2] 6,266	7,359	e 8,200

e Estimate. p Preliminary. r Revised. NA Not available.

[1] In addition to commodities listed, construction materials such as sand, gravel, and quarried stone are also produced, but quantitative data are not available.

[2] Includes 331,000 barrels of other products, including bases and intermediates.

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Table 2.—Tunisia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum, metal, including alloys, all forms		141	138
Copper, metal, including alloys, all forms		557	907
Iron and steel:			
Ore and concentrate	thousand tons	775	654
Metal:			
Scrap		21,834	19,226
Pig iron, ferroalloys and similar materials		81,066	27,098
Steel, ingots and other primary forms		2,220	2,745
Semimanufactures		12,405	39,616
Lead:			
Ore and concentrate		1,472	2,600
Metal, unwrought		12,230	12,800
Mercury	76-pound flasks	145	203
Silver, metals, including alloys	troy ounces	32,151	133,779
Zinc, ore and concentrate		13,338	-------
NONMETALS			
Cement		1,770	56,639
Clays and clay products (including refractory brick)		32,335	48,279
Feldspar and fluorspar		1,994	500
Fertilizer materials:			
Crude, phosphatic	thousand tons	2,314	2,445
Manufactured, phosphatic	do	332	347
Salt	do	278	323
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude	thousand 42-gallon barrels	12,058	16,444
Refinery products:			
Gasoline and jet fuel	do	689	999
Distillate fuel oil	do	152	628
Residual fuel oil	do	5	7
Total	do	846	1,634

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Table 3.—Tunisia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Alumina	115	201
Metal, including alloys	580	555
Copper, metal, including alloys, all forms	1,181	502
Gold, metal, unworked or partly worked—thousand troy ounces	23	22
Iron and steel:		
Metal:		
Scrap	65	137
Pig iron, ferroalloys, and similar materials	449	1,256
Steel:		
Ingots and other primary forms	17,180	63
Semimanufactures	73,551	41,995
Lead, metal, including alloys, all forms	117	90
Mercury—76-pound flasks	9	35
Silver, metal, including alloys, all forms—troy ounces	37,006	51,731
Zinc, metal, including alloys, all forms	232	112
NONMETALS		
Abrasives, natural, n.e.s	78	284
Asbestos	2,165	1,085
Barite and witherite	2,891	2,169
Cement	43,838	12,089
Clays and clay products (including refractory bricks)	19,522	10,502
Diatomite and other infusorial earths	38	57
Feldspar and fluorspar	1,208	679
Fertilizer materials, manufactured	r 29,290	31,797
Gypsum and plasters	403	659
Sodium and potassium compounds, n.e.s	3,944	4,409
Stone, sand and gravel	6,487	3,719
Sulfur:		
Elemental, all forms	124,156	144,889
Pyrite, unroasted	7,766	7,962
Talc, steatite, soapstone and pyrophyllite	441	1,189
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets	37,637	28,663
Coke and semicoke	108,185	100,571
Petroleum:		
Crude—thousand 42-gallon barrels	2,073	NA
Refinery products—do	324	332

r Revised. NA Not available.

COMMODITY REVIEW

METALS

Iron and Steel.—During the floods the El Fouladh Iron and Steel Mill, near Bizerte, was cut off from its ore supply from the Djebel Djerissa mine. Company officials hoped that the supply of ore from the Tamera–Douaria mine would be sufficient to permit the mill to operate near capacity; the company reportedly considered importing ore to make up any deficit.

In June a contract was awarded to Compagnie des Ateliers et Forges de la Loire, a French company, to build a 10,000-ton-per-year wire drawing plant at the mill. The plant will produce soft steel wire and steel wire for reinforced concrete. It is scheduled to be operating by September 1970. The total cost of the plant is estimated at $4.2 million.

NONMETALS

Fertilizer Materials.—Tunisia's reserves of phosphate rock were estimated at 130.5 million tons; total probable reserves are near 425 million tons. The quality of the reserves at the Moulares and Redeyek mines, two large producers, continued to decline.

Production and shipments of phosphate rock were disrupted by the floods. Large sectors of the railroad between the phosphate mines near Gafsa and the port of Sfaz were washed away. The railroad was rebuilt on a temporary basis in late November, and shipments were resumed at a daily rate of about 7,000 tons, compared with the normal rate of about 12,000 tons. Only the M'Dilla mine was reported to have been damaged seriously, but all the mines in the area were closed until the railroad was rebuilt. The lost production is estimated to have cost the economy $5 million.[3] To aid the phosphate industry during the disruption, Morocco sent 22,000 tons of phosphate as a gift.

[3] Phosphorus and Potassium. No. 45, January–February 1970, p. 2.

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Late in the year the Government signed a contract whereby S.A. Heurtey, a subsidiary of the French company Maison Bergeon, is to study ways to resolve some of Tunisia's phosphate industry's long-standing problems. These are as follow: Output of low-grade ore (65 to 68 percent calium phosphate); low productivity per worker (about 3 tons per day); and a high cost of production because of the small amount of mechanization and outmoded beneficiation plants. The Government hopes to achieve an annual rate of production of 7.5 million tons of high-grade phosphate rock (72 to 75 percent calcium phosphate) by 1975. Implementation of these projects will cost an estimated $40 million.

Under an agreement signed during the year, Pierrefitte, a French company, is to provide technical assistance for the 100,000-ton-per-year phosphoric acid plant being built at Gabes. The plant is scheduled to be operating in 1971. Another French company, Gazocean, joined Industries Chimiques Maghrébines S.A. to form Gabes–Chimie–Transports, which will be responsible for shipping phosphoric acid.

In 1968 exports of phosphate rock were valued at $23.2 million and continued to rank as the country's second most important export item after crude oil. The principal destinations of crude phosphate in 1968 were France (620,000 tons), Poland (324,000 tons), Yugoslavia (285,000 tons), and Greece (239,000 tons).

MINERAL FUELS

Petroleum.—Tunisia's petroleum reserves in 1969 were estimated at 500 million barrels of crude oil and 1,000 billion cubic feet of natural gas.[4] The crude oil reserves ranked about sixth in Africa.

The El Borma field continued to account for most of the crude oil production. The Cap Bon gasfield remained the only producer of gas that was used commercially. The field also produces about 11,000 barrels of condensate per year.

Production from the Douleb oilfield was stopped during October because the pipeline to La Skhirra was shut down due to the widespread flooding. A small field at Tamesmida, about 30 kilometers southwest of Douleb, may be brought into production, although the output is expected to be only about 230,000 barrels per year.

In February an agreement was signed that permitted oil from the Algerian part of the El Borma field to flow through Tunisia to La Skhirra. A short pipeline connects the Algerian part of the field to the pipeline in Tunisia. The Algerian El Borma crude oil began to flow in late September. The average rate of flow during the year was about 9,500 barrels per day. The rate is scheduled to rise to about 19,000 barrels per day in January 1970.

The agreement also established a working committee to study the possibility of importing natural gas from Algeria, presumably for use at the petrochemical complex under construction at Gabes.[5] The Government has considered building a pipeline to El Borma so that it could get natural gas for the complex.

Receipts from the pipeline of Compagnie des Transports par Pipelines au Sahara (TRAPSA) totaled $14.7 million in 1969, compared with $85.7 million in 1968. The line carries oil from fields in southeastern Algeria to the port of La Skhirra.

The 22,500-barrel-per-day refinery at Bizerte was being considered for expansion to about 33,750 barrels per day. A proposal was also made to build a refinery at Sfax. Considering the country's requirements for petroleum products, only one of the proposals seems likely.

Late in the year there was an announcement that a petroleum institute will be created and begin functioning in 1970. The purpose of the institute will be to train Tunisians in petroleum industry techniques and to develop new petrochemical industries. Italy's Ente Nazionale Idrocarburi (ENI) will take part in forming the institute.

In 1968 crude oil exports, the country's chief export item, were valued at $26.8 million, compared with $20 million in 1967. The principal destinations in 1968 were West Germany (8.2 million barrels), Switzerland (5.1 million barrels), and France (2.2 million barrels). No crude oil was imported in 1968.

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[4] Oil and Gas Journal. V. 67, No. 52, Dec. 29, 1969, p. 95.
[5] Petroleum Press Service. V. 36, No. 6, June 1969 p. 213.

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The Mineral Industry of Turkey

By E. Shekarchi [1]

The mineral industry of Turkey experienced another successful year in 1969, with the gross value of mineral and metal production approximating $580 million. Copper, boron minerals, chromite, and recently magnesite, remained the main contribution to the world mineral supply.

The Turkish economy showed continued healthy and systematic expansion. The estimated gross national product (GNP) for 1969, as in 1968, showed a 6.5-percent real increase, reaching nearly $11.6 billion.[2] Per capita GNP, based on 1968 dollars, was estimated at $360 compared with $346 in 1968. Generally, foreign exchange earnings were expected to rise in 1970 as exports of all commodities, particularly minerals, continued to expand and import levels continued to decrease.

Maden Tetkik ve Arama Enstitüsü (MTA), the mineral Research and Exploration Institute, continued its efforts in exploration and development of new mineral deposits, including evaluation of bauxite deposits and phosphate mineralization, remapping iron ore deposits, geological mapping, and extensive research on copper findings. MTA has transferred all activities to the new headquarters which facilitates close collaboration among various divisions and promises better research for the future.

Dravo Corp. of Pittsburgh, Pa., was awarded a $9.5 million contract to design, supply, and supervise construction of an iron ore sintering facility for the Eregli steel plant. The project is part of an expansion program, which is being financed by the U.S. Agency for International Development (AID) and which was initiated in 1967 under a project loan to Turkey.

Construction of the new 1-million-metric-ton-per-year steel mill in Iskenderun, in southeastern Turkey on the Mediterranean coast, was scheduled to start at the beginning of 1970. The Soviet Union is supplying both financial and technical aid, amounting to $265 million and utilizing 600 Soviet engineers to supervise the work force of 20,000 employees. All equipment will be received from the Soviet Union by 1974 and apparently the first steel products will be marketed in 1975.

During the latter part of 1969, the Turkish Government signed a contract for the first bridge to be built linking Asia and Europe across the Bosporus, the eastern strait which lies between the Sea of Marmara and the Black Sea. The Hochtief Company of West Germany will construct the foundation for the mile-long bridge, while Britain's Cleveland Bridge and Engineering Co. will build the superstructure which accounts for 80 percent of the contract value and which totals $38 million. The completed project will include an access highway and another 3,000-foot bridge over the Golden Horn, all of which are to be built by Japan's Bridge Consulting Company at a cost of $140 million. It is planned to be completed by 1973.

PRODUCTION

Increases in both quantitative and gross value of mineral production in 1969 were worthy of note. Available information indicated an approximate 10-percent increase in gross value of minerals production between 1968 and 1969. Noteworthy quantitative increases were reported in production of metallic minerals: Chromite 7.2 percent;

[1] Foreign minerals specialist, Bureau of Mines, Washington, D.C.

[2] Where necessary, values have been converted from Turkish lira (TL) to U.S. dollars at the rate of TL1=US$0.11.

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ferrochrome 8.2 percent; and iron ore 22 percent. Only manganese ore production decreased by 48 percent.

Among the nonmetals, increases in output were as follow: Boron minerals 21 percent; barite 63 percent; magnesite 86.2 percent; and petroleum 23 percent.

In 1969, Turkey added a new commodity to its mineral output with the production of 1,500 metric tons of phosphate rock in a pilot plant operation. A significant production of aluminum is expected by 1973–74 when the facilities for the production of alumina in Seydişehir will be completed.

Table 1.—Turkey: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1967	1968	1969 [p]
METALS				
Aluminum, bauxite		21,490	NA	1,500
Antimony: [2]				
Ore and concentrate		2,035	3,126	2,550
Regulus		55	125	110
Chromite (all grades)		371,138	r 416,000	446,000
Copper:				
Mine production (contained metal)		30,988	28,823	26,374
Blister from other domestic ore		25,390	23,620	19,270
Ferrochromium		8,471	8,500	9,200
Iron and steel:				
Iron ore	thousand tons	1,485	1,989	2,429
Pig iron and blast furnace ferroalloys	do.	847	910	943
Steel ingots	do.	1,056	1,109	1,170
Lead:				
Content of concentrate		2,358	2,216	2,851
Metal •		2,156	2,000	2,000
Manganese ore		17,307	25,350	13,229
Mercury	76-pound flasks	4,147	4,320	• 4,800
Zinc:				
Zinc-lead ore, hand-sorted		18,448	24,392	28,371
Zinc ore, calcined		7,150	11,900	15,036
Zinc concentrate		1,342	1,333	1,690
Zinc content of ore and concentrate		3,689	4,878	6,809
NONMETALS				
Asbestos		2,196	3,183	4,629
Barite		31,590	20,293	33,074
Boron minerals		287,607	265,883	323,470
Cement	thousand tons	4,249	4,733	5,795
Clays, including fire clay •	do.	15,000	15,000	13,000
Emery		31,125	30,864	43,457
Fertilizer (chemical)		359,804	335,130	370,776
Fluorspar		• 1,500	2,004	2,094
Gypsum •	thousand tons	220	220	220
Magnesite (crude ore)		84,959	117,735	219,256
Marble •	cubic meters	30,000	50,000	50,000
Meerschaum	kilograms	67,510	39,300	39,750
Phosphate rock				1,500
Pyrite, cupreous (gross weight)		125,000	136,536	129,841
Salt, all types •	thousand tons	400	567	570
Sodium sulfate		11,289	11,037	13,785
Sulfur		25,384	24,180	25,022
MINERAL FUELS AND RELATED MATERIALS				
Bituminous coal (salable)	thousand tons	5,031	[3] 7,506	[3] 7,731
Coke, all types	do.	1,362	1,430	1,594
Fuel briquets •	do.	50	50	50
Lignite (salable)	do.	4,468	[3] 6,386	[3] 8,469
Petroleum:				
Crude	thousand 42-gallon barrels	17,459	19,871	[3] 24,531
Refinery products:				
Gasoline	do.	6,774	8,391	8,370
Kerosine and jet fuel	do.	3,040	4,912	5,372
Distillate fuel oil	do.	9,393	11,221	10,623
Residuel fuel oil	do.	15,804	18,419	20,602
Liquefied petroleum gas	do.	126	1,535	NA
Other (includes asphalt, solvent, and miscellaneous)	do.	899	1,151	2,892
Total	do.	36,036	45,629	47,859

• Estimate. r Revised. NA Not available. p Preliminary.

[1] In addition to commodities listed, Turkey produced about 3 million metric tons of limestone and 400,000 metric tons of dolomite in 1969.

[2] Run of mine.

[3] Refinery throughput from domestic production.

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TRADE

The value of total mineral commodity exports in 1968 approached $42.5 million, which was about $1 million higher than 1967 but $12.1 million short of the record year 1966. The main contributors to 1968 export income were copper, chromite, borate ore, and magnesite.

The total value of mineral commodity imports in 1968 was about $134.8 million, which is a record low in recent years. In Turkey both Government and private investors are aiming at reducing the 1968 import figure even more. The value of mineral commodities' trade and value of total commodity trade are presented in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1967	41.5	523.0
1968	42.5	496.0
Imports:		
1967	139.5	690.8
1968	134.8	770.0

Table 2.—Turkey: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Antimony, ore and concentrate	2,627	2,014
Chromite, including all grades	312,972	386,000
Copper, metal, including alloys, blister	16,078	15,192
Ferrochromium	5,206	9,833
Manganese, ore and concentrates	5,830	8,285
Mercury 76-pound flasks	4,543	3,103
Pyrite, cupreous	119,370	119,700
Tungsten, ores and concentrates (45 percent)	27	54
Zinc:		
Calcined ore	780	7,865
Concentrate	-------	1,000
Lead sulfide ores	15,000	16,197
Metallic slags and scrap	703	2,694
NONMETALS		
Abrasives, emery	22,026	-------
Asbestos	-----	23,500
Barite	22,873	16,682
Borates	211,332	231,958
Magnesite:		
Crude	14,515	32,486
Calcined	22,310	22,991
Meerschaum	110	39
Salt	6,800	-------
Stone, sand and gravel, marble	2,912	4,090
Other nonmetals	135	90
MINERAL FUELS AND RELATED MATERIALS		
Coal, bituminous	2,801	4,400
Petroleum refinery products:		
Gasoline	-------	8,678
Residual fuel oil	-------	148,655

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Table 3.—Turkey: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, all forms:		
Ingots	9,275	-------
Semimanufactures	4,673	15,622
Copper, metal, including alloys, all forms	746	380
Iron and steel, metal:		
Scrap	39,027	64,374
Pig iron, including cast iron	21,313	26,103
Ferromanganese and other ferroalloys	7,677	8,772
Ingots and other primary forms	123,998	167,261
Semimanufactures	91,705	80,111
Lead, metal, including alloys, all forms	4,861	4,584
Nickel, metal, including alloys, all forms	253	200
Tin, metal, including alloys, all forms	881	1,109
Zinc, metal, including alloys, all forms	6,134	1,962
Metallic ores, slags and ashes	457	86
Other nonferrous metals and semimanufactures	50	384
NONMETALS		
Asbestos	5,884	8,311
Barite	-------	25
Cement	178,458	360,650
Clays and clay products	1,789	2,687
Feldspar and fluorspar	3,792	1,199
Graphite	236	247
Meerschaum, agglomerated	366	-------
Mica	45	26
Phosphate rock	95,104	273,817
Quartz and quartzite	658	591
Stone, sand and gravel, crushed rock	231	-------
Sulfur	601	4,661
Talc	139	119
Other	487	3,085
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	-------	8,272
Coal	331	-------
Coke	3,675	16,091
Petroleum:		
Crude—thousand metric tons	2,480	2,968
Refinery products:		
Gasoline	19,563	83,635
Kerosine	44,408	169,434
Fuel and residual oils	171,895	73,641
Lubricants	90,077	124,649
Pitch and residues	206	3,336
Other (paraffin and vaselines)	3,201	3,198
Total refinery products	329,350	457,893

COMMODITY REVIEW

METALS

Aluminum.—Bauxite production in Turkey was reported for the first time in 1969. The small ouput, 1,500 metric tons, was used as feed for a pilot plant crrying on various experiments on bauxite from the newly discovered large deposit.

Construction work on the aluminum plant at Seydişehir, backed financially by the Soviet Union, continued in 1969. It is anticipated that the plant, when in full operation in 1973, will save Turkey considerable foreign exchange. The plant will produce 60,000 metric tons of aluminum per year.

Chromite and Ferrochromium.—In 1968, 386,000 metric tons of chromite ore was exported to European and U.S. markets. This is an increase of 18 percent over the 1967 export level. Production of chromite in 1969 increased 7.2 percent over the 1968 output. The increase, though negligible, was due to the greater demand for Turkish metallurgical-grade ore on the international market, a result of imposition of United Nations sanctions on Southern Rhodesia. Basically, the pattern of production was essentially the same as in previous years; Etibank accounted for about 45 percent of total production and the private sector produced the rest.

Ferrochrome output showed an increase in 1969 of 8.2 percent over the 1968 production. The production of ferrochrome is geared mainly for export to European markets, primarily France, since Péchiney

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of France is a partner in the Antalya plant and responsible for marketing. Export of ferrochrome in 1968 made an impressive increase of 88 percent over that of 1967.

Although feasibility studies continued, no firm decision was reached on plans for a new 40,000-metric-ton-per-day ferrochrome plant in southeast Turkey near the Keban Dam, which is under construction.

Copper.—Construction work on the Black Sea copper project in Samsun, under the directorship of Karadeniz Bakir Isletmeleri (KBI), continued during 1969. Completion is expected in 1971 and the plant, which will have an annual capacity of 4,000 metric tons of copper, is licensed to use Outukumpu Oy's flash smelting process. Terms of the contract for this project also call for the erection of a 300,000-metric-ton-per-year sulfuric acid plant which should be ready by 1971.

Authur G. McKee, and Co. a U.S. consulting firm, has contracted this complex in addition to a 60-kilometer pipeline to be constructed for carrying the copper concentrates from the mine at Murgul to the port at Hopa on the Black Sea coast. The concentrates will be shipped to the Samsun smelter for processing and beneficiation.

Production of both blister copper and mine copper declined in 1969, 18 percent and 9 percent, respectively. However, several increases in the price of copper on the international market compensated for the quantitative decreases.

Geochemical work carried on in 1969 at Maden, a copper mine in the southeast region, was not concluded by yearend. Authorities hope that a second ore body can be found below the present almost depleted high-grade ore body.

Iron and Steel.—In 1969, after a thorough search and a feasibility study of the domestic and export market, the Turkish Government and the U.S.S.R. signed an agreement to build a $265 million iron and steel plant at the Mediterranean port of Iskenderun. The groundbreaking ceremonies took place in 1969 and actual construction is expected to begin in 1970. Completion will take 5 years. The plant will have an initial annual capacity of 1.2 million metric tons and, when completed, a capacity of 2 million metric tons. Most of the financing will be paid in Turkish exports over a period of 15 years, at an annual interest rate of 2.5-percent, through a mechanism of trade between Turkey and the U.S.S.R.

Production of iron ore showed an impressive increase of 22 percent in 1969 over that of 1968, while the production of pig iron and blast furnace ferroalloys and steel ingots remained essentially on the same level as the previous year.

With the completion of the Iskenderun steel mill, Turkey will be able to satisfy most of its domestic market requirements; however, for specially alloyed steel, the country will depend on foreign sources.

Lead-Zinc.—It was reported that feasibility studies carried out on lead-zinc deposits near Kayseri by the State Planning Organization (SPO) and Turkish engineering concern, Metag, have revealed a substantial amount of high-grade ore. A $27 million Imperial Smelting furnace was proposed to process the ore. However, neither the amount of proven ore nor the percentage of lead-zinc content were available by yearend.

Production of lead-zinc ore and export of these commodities in 1969 remained essentially the same. It was suggested, however, that when the Kayseri plant becomes fully operational, an additional 60,000 metric tons of lead-zinc will be available for the export market.

Manganese.—Production of manganese declined 48 percent in 1969 from the output of 1968 which was a record high for the last 6 years. Export of mostly metallurgical-grade manganese ore in 1968 showed a 42-percent increase over the previous year. The significant producers in 1969 continued to be the mines near Silivri in Thrace, northwestern Turkey and the Cöplerköy mine northwest of Erzincan in Anatolia.

Mercury.—Production of mercury though showing a slight increase in 1969, remained well below the target export predicted by SPO in 1968. Both new facilities continued to make significant improvements but were not ready to contribute appreciably to the 1969 output.

One of the plants is located near Odemis on the Karaburun peninsula and is owned by the private concern of Metaş Medençilik ve Ticaret Ltd. Skt. The other new installation, located at Ludik-Sizma near Konya, is owned by Etibank.

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Compared with 1967, exports of mercury decreased by 46 percent in 1968 and contributed almost $1.8 million to the Turkish economy.

NONMETALS

Barite.—Production of barite in 1969 increased 63 percent over production of the previous year. Export of barite in 1968, however, fell below the 1967 level by approximately 6,000 metric tons, bringing to Turkey foreign exchange of almost $186,000.

Bentonite.—MTA discovered extensive high-grade deposits of bentonite in the Çankiri district, 70 kilometers northeast of Ankara, during its 1969 exploration activities. The Turkish authorities, encouraged by the size and grade of the deposits, were planning construction of a small processing plant to separate the bentonite for use in local foundries.

Boron.—Production of boron minerals reached a new high in 1969, increasing 21 percent over 1968. Etibank (public sector) remained the main producer in the country, followed by private producers, such as Türk Boraks Madençilik, a subsidiary of Borax Consolidated Ltd., and Rasih ve Ihsan, and Hasmettin Yakal.

Exports of boron minerals in 1968 increased 9 percent over those of 1967 and contributed $6.6 million to Turkey's much needed foreign exchange earnings.

Etibank, the State mining enterprise, in order to increase its production to a competitive level on the international scene, was planning to install a 150,000-ton-per-year concentrator to upgrade the run-of-mine minerals at Emet, in Kutahya, by reducing the iron and arsenic content of the ore. Certainly the new mill can open up new markets for colemanite and will enable Etibank to satisfy the feedstock needs of Bandirma's borax-acid plant.

The dispute between the Ministry of Energy and Natural Resources of Turkey and Turkish Borax Company over the cancellation of exploitation licenses for five borax deposits held by Turkish Borax was reaching a climax in 1969. It appeared evident that the company would lose all the permits. According to the local press, the five deposits, located near Seyitgazi, Eskişehir, contain over 600 million tons of ore. Furthermore, according to the local press, a sixth deposit, with 200-million-ton reserves, also near Eskişehir and owned by the Borax Consolidated Company, was to be turned over to an American "trust," the Rio Tinto Zinc Co. Details of the transaction were not available by yearend 1969.

Cement.—The Government announced in 1968 a cement industry expansion program with the aim of increasing production to 9 million metric tons by 1972. To implement the program, the Hostas Holding Co. was awarded contracts for construction of two cement plants in Ceyhan in southeastern Turkey. One of the plants, Hostas Cement Plant, will have a capacity of 1 million metric tons per year. The second plant will be called Hostas Cement Product Plant. The company plans to produce an amount of cement and cement products, not only sufficient to meet most of the domestic requirements, but also, since it has an advantageous location on the Mediterranean, to export cement and cement products by 1973.

Although cement production increased 22.4 percent between 1968 and 1969, domestic demands were not met and Turkey had to import several thousand tons from foreign sources. Imports of cement in 1968 increased almost 50 percent over 1967 imports.

Fertilizer Materials.—Ten years ago Turkey's consumption of fertilizer materials was negligible, while today almost 250,000 metric tons of plant nutrients are consumed annually. The increase is due to the activities of the Freedom From Hunger Campaign (FAO) as well as to very effective Turkish Government efforts which include fiscal credit and price policies, technical education, and major undertakings such as irrigation, model farms, marketing organization, and a credit policy on the basis of deferred payment.

The fertilizer industry as a whole is undergoing a general expansion. The most ambitious developments are taking place in the manufacture of phosphate fertilizers where the Government and private enterprise have combined their efforts in projects which should give Turkey a large measure of self-sufficiency by early 1975.

It was announced in the latter part of 1969 that a 5-year contract had been concluded between the Tunisian Phosphate Rock Industry and the Turkish Nitrogen Industry, under which Tunisia will supply raw materials to three fertilizer plants currently under construction in Samsun, Mer-

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sin, and Elazig. Apparently deliveries will begin when plants are completed in 1971.

Available information indicates that the Elazig plant in eastern Turkey was scheduled to come into production in the latter part of 1970. Initially, the plant will produce 100,000 metric tons of chemical fertilizers annually; however, this output subsequently will be increased to meet the design specification of 220,000 tons.

The Mersin plant is scheduled for completion in 1971 at a cost of about $13.3 million with a designed capacity of 200,000 metric tons of fertilizer: Phosphoric acid, 215 tons per day; diammonium phosphate, 450 tons per day; and nitric acid, 1,100 tons per day.

A $45 million petrochemical complex was being set up by Petrokimja S.A. at Izmit close to the existing refinery. It was to produce 12,000 tons per year of polyethylene; 26,000 of polyvinyl chloride; and 20,000 of proplene by the end of 1971. Later additions to this plant were projected to produce carbon black and polystyrene.

Another $50 million fertilizer complex was planned by the Government at Mersin, called Mediterranean Fertilizer Industries A.S., in which Turkish Azot Sanayii and Kuwait Petrochemical Industries each control 40 percent of the stock and Turkish private capital holds the remainder. The plant is slated to manufacture 1,800 tons per day of calcium ammonium nitrate and diammonium phosphate.

In Turkey most fertilizer materials are sold through Turkiye Zirai Donatim Kurumu, the Government agriculture supplies organization. Private merchants do import fertilizer material, but these imports have been estimated to amount to not more than 15 percent of the total demand.

Lime.—In June of 1969, a contract was signed between the KGM Export Company of Hungary and the Tekno Holding Company of Istanbul, Turkey, to supply all the equipment for a lime and lime hydrating plant. Installation will include two kilns with a daily output of 200 metric tons of quicklime and a hydrate unit with a daily capacity of 7 tons. The total cost was estimated to be about $250,000.

Magnesite.—Production of crude magnesite reached another high with an 86-percent increase in 1969 over the 1968 record year. However, production of calcined magnesite remained essentially the same as in the previous year. Exports of magnesite in 1968, primarily crude ore, were principally to Austria, followed by Belgium-Luxembourg, and showed a substantial increase of 123 percent over the 1967 export level. Magnesite, a fairly recent mineral industry in Turkey, contributed more than $2 million to overall foreign exchange earnings of Turkey, and the future of the industry seemed brighter by the end of 1969.

The new chrome-magnesite refractory plant at Konya, a joint venture of the State-owned Sumer Bank and Maruhendi Idla Company Ltd. of Japan, completed its trial shakedown period during the first part of 1969 and was officially inaugurated in March of 1969. The cost of the entire venture was reported to be about $7.6 million. Annual production is expected to be 4,300 metric tons of dead-burned magnesite and 16,000 metric tons of various chrome-magnesite firebricks and building material. Turkey was expecting to earn close to $4.6 million annually from the export of products manufactured in the Konya plant.

Pyrite.—Production of pyrite in 1969 decreased 4.9 percent from the previous year's output. Exports of pyrite in 1968 remained essentially the same as exports during 1967.

Ore bodies such as Bakir Baba remained undeveloped in anticipation of completion of the Black Sea copper project and smelter in Samsun.

MINERAL FUELS

Coal.—Coal production, primarily from the Zonguldak basin, remained about the same in 1969 as in 1968 with only a slight increase. No detailed information was available on production by mines as reported in previous years. As a result of credit and technical assistance from the United States, U.S.S.R., and West Germany, Turkey was planning to increase considerably the country's output of coal in order to cope with future demand. At the present time Turkey produces close to 8 million metric tons of coal annually, of which nearly 4 million is bituminous coal and 4 million brown coal. With completion of the Iskenderun steel plant, a Soviet aid project, it will be necessary to accelerate production in Zonguldak and possibly utilize the nearby coal basins of the southwest.

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Leading Japanese commercial firms were studying Turkish coal as a source of new energy material for Japan's industrial complex. In 1969 it was estimated that Turkey could supply about 400,000 metric tons of coal to Japan annually. However, the results of further negotiations between the two nations were not made available at yearend.

Petroleum.—Crude petroleum output in Turkey during 1969 showed an increase of about 23 percent over that of 1968. The available information listed the output of individual producers as follows: Turkiye Petrolleri Anonim Ortakligi (TPAO), 1,110,380 metric tons; Shell, 1,806,914 metric tons; Mobil Oil, 600,135 metric tons; and Ersan, 51,384 metric tons.

Offshore drilling activities were practically nil in 1969; however, a contract was signed between TPAO and Westates Petroleum Co. of Los Angeles to drill along the Continental Shelf of the Black Sea—approximately a 120-mile stretch from the Bulgarian border to east of the Bosporus. The agreement is a risk-bearing agreement and provides that if a commerical discovery is made, TPAO will repay 50 percent of exploration expenses and 50 percent of the subsequent costs and will receive 55 percent of any production. It was agreed that Westates Petroleum Co. would spend $1.5 million in 1970 and $3 million in 1971 if the company elected to maintain its interest.

TPAO and Gulf Oil Co. agreed in 1969 to joint operation of their adjoining licenses in the Gulf of Iskenderun and to drill three offshore exploratory wells in 1970. No details of the agreement were available.

The only active petroleum exploration work carried on in 1969 was reportedly by Shell and TPAO. There has been a steady drop in exploration interest since the late 1950's when more than 30 companies were engaged in exploration.

The result of TPAO's activity in the Sivas and Erzurum districts in 1967 were not published by yearend.

New concessions for oil exploration were granted during 1969 to both Shell and TPAO. Shell has an area of about 100,000 acres in the Mardin and Siirt region while TPAO obtained 200,000 acres in Koçaeli, Sakarya, Bolu, and Zonguldak districts, as well as in Mardin and Siirt. Exact acreage of the latter two districts were not given.

Pipeline.—A preliminary agreement between the Governments of Iran and Turkey which still requires ratification was signed in the latter part of 1969 to provide for a 1,500-mile pipeline to be laid between Ahwaz in southwest Iran and Iskenderun, a Mediterranean port in southeast Turkey. The pipeline would carry Iranian crude oil for markets in Europe. No other details of the agreement were available by yearend.

Refineries.—At the present time, there are three operating refineries in Turkey: (1) TPAO's refinery at Batman with a reported capacity of 26,000 barrels per day in 1969; (2) Mersin refinery, operated by Anadolu Tasfiyehanesi A.S. (Ataş) and owned by Mobil Oil—56 percent, by Shell—27 percent, and by British Petroleum—17 percent, which produced 91,000 barrels per day during 1969; and (3) the Izmit plant, owned by Istanbul Petrol Refineresi A.S (IPRAS)—46 percent, by TPAO—5 percent, and by Caltex—49 percent, which produced about 100,000 barrels per day at yearend.

In the blueprints, there was a new $30 million refinery which is to be built for TPAO at Izmir on the Aegean Sea. This refinery, which intends to serve most of the western part of Turkey, will have a capacity of 60,000 barrels of petroleum daily. It will be built and financed by U.S.S.R. under a credit agreement providing loans for a number of industrial projects. The construction work apparently started in 1969.

Marketing.—Petrol Ofisi, the State company, has the largest share of the petroleum product market, about 27 percent, and TPAO has about 12 percent. The private sector companies had the following market shares in 1969: Mobil Oil, 23 percent; Shell Oil Co., 16.5 percent; and British Petroleum Co., 10.8 percent. Smaller private companies such as Caltex, Turk Petrol, and other local firms shared the remaining marketing of petroleum products in 1969.

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The Mineral Industry of the U.S.S.R.[1]

By V. V. Strishkov [2]

The U.S.S.R. maintained its position in 1969 as the world's second largest producer of industrial products. Compared with the previous year, production of electric power increased by 51 billion kilowatt-hours, petroleum by 18.8 million tons,[3] gas by 12 billion cubic meters, raw coal by 14 million tons, pig iron by 2.8 million tons, steel by 3.5 million tons, finished rolled ferrous metal by 2.1 million tons, mineral fertilizers by 2.5 million tons, and cement by 2.3 million tons. There was also a 6.8 percent increase in the output of nonferrous metals. Significant mining developments were underway in all branches of the mineral industry. Exploration for ferrous and nonferrous metals, fuels, and nonmetallics was continued, and offshore exploration for oil and gas was underway in the Caspian Sea. In international perspective, the U.S.S.R. was the world's leading producer of iron, manganese, and chromium ores, platinum-group metals, lead, potassium salts, and cement; second (to the United States) in aluminum, copper, steel, petroleum, natural gas, coal, and phosphate rock; (to Canada) in zinc, nickel, silver, and asbestos; and (to the Republic of South Africa) in gold.

Shipments of practically all of the Soviet mineral commodities that are exported were at increased levels in 1969. Fuel exports were the largest and fastest growing commodity group in Soviet trade. The rate of growth of oil and gas exports may increase in spite of rising home demand and technical difficulties of production and transport. Despite the development of the mineral industry, the economy lacked many mineral raw materials required by Soviet industry.

The expansion of the mineral industry continued to be achieved mainly by the commissioning of new mines and plants, rather than by rationalization of existing facilities. Emphasis was largely on increases in gross production rather than on efficiency and product quality. A considerable part of industrial output did not meet Soviet standards of quality.

Goals of the 1969 plan were not fulfilled in many areas of the mineral industry. The production of iron ore, pig iron, steel, natural gas, cement, mineral fertilizers, and many other mineral commodities was below both industry requirements and 1969 plan targets. Four years have passed since the decision to introduce economic reform in the country. The main feature of the reformed system was that the value of sales would replace the value of production as the main indicator of the success of all industrial enterprises. There was no evidence that the reform had any effect on production methods or on labor productivity, although it freed consumers in some degree from the centralized distribution of products in short supply. According to the Soviet Economic Gazette:

> ". . . enterprises were achieving increased profitability not by making better use of production facilities, material, and labor resources, but by violating the established wholesale prices." [4]

Izvestiya commented in November that,

> ". . . the reality of the reform, which is more or less tangible for engineers, technicians and enterprise managers, is slow in reaching the workers and is not creating real additional incentive for them.[5]

Labor productivity was low in the mineral industry. This was due to the large amount of manual work, turnover of work-

[1] This publication is based entirely on a review of the sources published by the U.S.S.R.
[2] Soviet Union specialist, Bureau of Mines, Washington, D.C.
[3] All tons in this publication are metric tons.
[4] Ekonomicheskaya Gazeta (Economic Gazette). Moscow, No. 1, January 1969, pp. 24–25.
[5] Izvestiya. Moscow, Nov. 27, 1968, p. 1.

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ers, and delays in production.[6] From 50 to 65 percent of the workers were engaged in ancillary jobs in all branches of the Soviet mineral industry in 1969. At many mines and plants, up to half of the production workers were employed in manual labor, including surface loading and unloading. Few roof support operations were mechanized.

The production of mining and metallurgical equipment has grown substantially, but the technical standards and the quality of equipment produced are poor and "do not always answer modern requirements".[7] Many plants preferred to manufacture outdated equipment rather than undertake new technology.[8] More than half of the machinery employed in the mineral industry was idle. This was related to the quality of the machines and the unsatisfactory supply of spare parts and materials at the mines and plants.

In 1969, there was a turnover of almost one-third of the workers at the enterprises of the nonferrous industry and 40 percent in the chemical industry.[9] This was attributed mainly to inadequate housing and medical and public services, low material incentives, and the heavy manual work involved. Large numbers of women were employed in the mineral industry, some in underground work.

There were about 1.4 million "production workers" and some 75,000 university graduate engineers and 125,000 graduate technicians in the Soviet ferrous industry in 1969. The coal industry employed over 2.9 million, including about 61,500 university graduate engineers and 141,000 technicians. The oil, gas, and petochemical industries employed 2.6 million. There were 500,000 employees in the geological prospecting organizations of the U.S.S.R., including over 100,000 specialists with university and technical education. As a whole, 69 percent of the graduate Soviet engineers performed various kinds of work not requiring specialized university training.[10]

To ease the shortage of labor, many employees were permitted to hold more than one job, and able-bodied pensioners were encouraged to supplement their incomes by returning to active employment.

The average monthly earnings of the Soviet workers and employees was 117 rubles[11] in 1969, or 3.9 percent over those of 1968.

Although the U.S.S.R. does not publish statistical data on injuries in the mineral industry, available Soviet information discloses that fatal injuries in the mineral industry were high.

Consumption of materials exceeded established patterns at many enterprises and construction projects, particularly those of metals, fuels, electric power, and cement. Stocks of materials and equipment were 50 to 80 percent higher than necessary. Because of improper storage, metal and other mineral products deteriorated and frequently were not suitable for use. Losses of metal, fuel, and other materials continued to be excessive. According to Soviet sources, the U.S.S.R. used between 25 and 100 percent more ferrous metals per unit of industrial output than did the United States.

The U.S.S.R. continued to experience considerable difficulty in completing mineral projects on schedule because of shortages of materials, equipment, and funds.[12]

About 70 percent of the capital investments in the mineral industry was obligated in unfinished construction. Coal industry enterprises under construction in 1969 represented an estimated investment of 1.3 billion rubles.

Many mines and plants were put into operation in spite of numerous imperfections and insufficient equipment. Many enterprises and projects have operated over long periods with lower capacities than originally planned. On January 1, 1969, planned capacity had not been reached at 64 blast furnaces, 84 open-hearth furnaces and at 35 rolling mills. Basically, these were units where the date for reaching capacity was already past. In the cement industry the average productivity of all 18–185-meter rotary kilns was 443,000 tons per year, compared with the planned level of 600,000 tons.[13]

[6] Sotsialisticheskaya industriya (Socialist Industry). Moscow, Nov. 11, 1969, p. 2.
[7] Pravda. Moscow, Mar. 19, 1968, p. 4. Sotsialisticheskaya industriya (Socialist Industry). Moscow, Apr. 8, 1970, p. 2.
[8] Izvestiya. Moscow, Mar. 19, 1968, p. 3.
[9] Kommunist (Communist). Yerevan, Russian, Feb. 25, 1970, p. 1.
[10] Literaturnaya gezeta (Literary Gazette). Moscow, Sept. 10, 1969, p. 10.
[11] Official exchange rate 1 rubel=$1.11. Approximate buying power of 1 ruble relative to prices in the United States for hard goods and food ranges about 20 to 50 cents.
[12] Material'no-tekhnicheskoye snabzheniye (Material and Technical Supply). Moscow, No. 10, October 1968, pp. 72–75.
[13] Stroitel'naya gazeta (Construction Gazette). Moscow, July 19, 1970, p. 3.

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Plans for new construction and renovation of other mineral enterprises were not fulfilled in 1969, including projects for iron ore, natural gas, coal, steel, mineral fertilizers, and cement.

The commissioning of production capacities through new construction and extension or renovation of existing facilities in 1969 was as follows, in million tons, except as noted:

Iron ore, crude	15.9
Coal, raw	13.3
Pig iron	3.3
Steel	6.5
Semimanufactures, ferrous	1.6
Mineral fertilizers	11.0
Cement	1.9
Powerplants, million of kilowatts	12.0

In spite of many problems, the growing Soviet mineral industry was the second largest in the world, and served its main purpose of production, with operating costs and efficiency secondary considerations.

Government Policies and Programs.—Soviet mineral policy continued to be based on the principle of maximum self-sufficiency at any price. As a result of this policy, the U.S.S.R. has become the most self-sufficient nation in minerals and metals among the world's leading industrial powers.

In the U.S.S.R., the actual cost of production, or the Soviet estimate thereof, is not the true factor in the selling price of a commodity on the domestic or international market. The Soviet system permits the establishment of selling prices at any level believed desirable to meet political and economic requirements. Therefore, many mineral ventures of the Soviet Union were uneconomic by Western Standards.

The goals of the 5-year plan were not fulfilled in many areas of mineral production. The new targets for 1970, which were approved by the Supreme Soviet December 19, 1969, are much lower than the original objectives set by the party congress in 1966. For coal, pig iron, steel, rolled metals, steel pipes, natural gas, mineral fertilizers, cement, and electric power, the reduction is substantial. The 1970 plan calls for an increase in aluminum output of 6.7 percent, copper 5.7 percent, and zinc 7.2 percent. The production of platinum-group metals, gold, lead, titanium, magnesium, and rare and other nonferrous metals are to be increased.

To carry out this plan, capital investment in 1970 was set at 76.5 billion rubles, 7.6 percent more than in 1969. Of these, about 6.6 billion rubles are being allocated for the fuel branches of industry, and over 3.3 billion rubles for the ferrous and nonferrous industries, or 200 million more than in 1969. Capital investment in the chemical and refining industry is to rise by 16.6 percent, and in machine building industry by over 41 percent.

According to the new plan, the generation of electric power in 1970 is to reach 740 billion kilowatt-hours, 7.7 percent above the 1969 level. To support this increase it is planned to complete 12 million kilowatts of new generating capacity. The completion of the Krasnoyarsk and Saratov hydroelectric plants at full designed capacity, is planned.

The level of Soviet industrial production in 1969 and that planned for 1970 follows, in million tons unless otherwise specified:

Commodity	1969		1970	
	Planned production	Reported production	Original 5-year plant target	New target
Iron ore	186.7	185.2	211.5	193.0
Pig iron	83.4	81.6	94-97	85.0
Steel	112.6	110.0	124-129	115.0
Rolled metal	89.6	87.5	95-99	91.0
Steel pipes	11.5	11.5	14-15	12.3
Cement	92.0	89.8	100-105	94.3
Mineral fertilizers	46.5	46.0	62-65	57.5
Raw coal (bituminous, anthracite, and lignite)	595.3	608.0	665-675	618.0
Coke	74.1	73.5	• 84.0	• 76.5
Natural gas (billion cubic meters)	185.8	182.8	225-240	195.8
Peat, fuel	• 65.0	• 60.0	92	• 65.0
Petroleum, crude	326.5	328.0	345-355	350.0
Power, electric (billion kilowatt hours)	687.0	689.0	830-850	740.0

• Estimate.

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PRODUCTION

Although mineral production statistics were not officially reported for all commodities, information is available on most basic materials. These, together with published information on industrial development provide the basis for estimating output of other commodities. Many of the estimated data in table 1 represent at best an order of magnitude. Production capacity for practically all mineral commodities was increased during the year.

Reportedly, 70 elements were produced in the U.S.S.R. in 1969. More than 80 percent of the petroleum, more than 50 percent of the coal, half of the steel, and two-thirds of electric power were produced in the Russian Soviet Federative Socialist Republic (R.S.F.S.R.). The Ukraine occupied first place in output of coking coal, manganese, and iron ore, and second place in natural gas. This republic continued to provide more than one-third of total Soviet coal and natural gas output, about 55 percent of iron ore, 50 percent of pig iron, more than 40 percent of steel and rolled metal, and nearly 50 percent of metallurgical equipment.

Kazakhstan occupied third place in Soviet mineral production and was the nation's leading producer of lead, copper, zinc, chromite, and rare metals. This republic held first place in the U.S.S.R. for the rate of growth in production of ferrous, nonferrous, and rare metals. Production of nonferrous and rare metals has increased almost 50 percent in Kazakhstan since the beginning of the 5-year plan in 1966. A large increase has been attained in the titanium-magnesium industry created in the republic only 5 years ago.

Reportedly, the ferrous and nonferrous metals industry within the R.S.F.S.R. showed an industrial growth rate of 6 percent, and that of the Ukraine registered a growth rate of only 2 percent in 1969.

Production of all nonferrous metals gained slightly. The Soviet nonferrous industry suffered from high production costs, low productivity, and excessive loss of metal during recovery processes.

Problems in the Donets coal basin arising from labor shortages and low productivity, aggravated by the exportation of petroleum fuels needed for domestic uses, resulted in the uneconomic transportation of coal from eastern regions to the European part of the R.S.F.S.R. and to the Urals. Such shipments amounted to about 95 million tons of coal in 1969. According to Soviet estimates this amount may increase several times by 1980.

Owing to shortages of some necessary raw materials and other supplies, there was a rapid increase in stocks at many establishments. Stocks at Soviet industrial enterprises as of July 1, 1967 were valued at 2.6 billion rubles. By the middle of 1968 however, the value of stocks held at Soviet enterprises totaled 4.5 billion rubles.[14] Over 10 per cent of these stocks were at mineral industry enterprises, which resulted in shortages of working capital for these enterprises.

[14] Izvestiya. Moscow, Nov. 27, 1968, p. 1.

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Table 1.—U.S.S.R.: Estimated [1] production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Aluminum:			
Ores and concentrates:			
Bauxite, 26 to 52 percent alumina	5,000	5,000	5,000
Nepheline concentrate, 25 to 30 percent alumina	1,000	1,000	1,000
Alunite ore, 16 to 18 percent alumina	1,000	1,000	1,000
Metal, smelter:			
Primary	965	1,000	1,050
Secondary	100	100	120
Antimony, mine output, metal content—metric tons	6,400	r 6,500	6,600
Arsenic, white (As_2O_3)—do	7,000	r 7,050	7,100
Beryl, cobbed, 10 to 12 percent BeO—do	1,200	1,200	1,250
Bismuth, mine output, metal content—do	40	r 45	50
Cadmium, metal—do	2,200	r 2,250	2,300
Chromite ore, 30 to 56 percent Cr_2O_3	1,570	1,650	1,700
Cobalt, mine output, metal content—metric tons	1,400	r 1,450	1,500
Copper:			
Ores, gross weight, 0.5 to 2 percent Cu	80,000	r 85,000	90,000
Blister:			
Primary	800	r 850	900
Secondary	160	r 170	180
Gold—thousand troy ounces	5,700	5,900	6,250
Iron and steel:			
Iron ore, 55 to 63 percent Fe [2]	168,246	r 176,616	185,200
Iron ore sinter [2]	123,185	128,235	132,900
Pellets [2]	2,870	7,186	9,400
Pig iron and ferroalloys: [3]			
Pig iron for steelmaking	64,147	67,792	71,500
Foundry pig iron	9,308	9,588	8,900
Spiegeleisen	91	75	200
Ferromanganese	911	944	900
Other blast furnace ferroalloys	355	389	100
Total	74,812	78,788	81,600
Steel: [3]			
Ingots	95,653	99,741	103,000
Steel for casting	6,582	6,791	7,000
Total	102,235	106,532	110,000
Semimanufactures:			
Heavy sections	28,230	29,983	30,500
Light sections			
Wire rods	6,454	6,589	6,570
Pipe stock	4,195	4,232	4,275
Tubes from ingots	1,239	1,310	1,500
Plates and sheets:			
More than 5 millimeters thick	8,729	9,232	9,600
Other	11,636	12,181	12,500
Total plates and sheets	20,365	21,413	22,100
Strip	6,468	6,901	7,400
Railway track material	8,276	8,370	8,460
Wheels, tires and axles	831	829	850
Unspecified, for sale	673	584	650
Other	65	98	90
Total semimanufactures	71,796	75,309	77,395
Selected end products: [4]			
Welded pipes and tubes	5,974	6,412	6,500
Seamless pipes and tubes	4,608	4,803	5,000
Total	10,582	11,215	11,500
Cold-rolled sheets	4,081	4,208	4,400
Tinplate	483	497	500
Galvanized sheets	384	451	500
Electrical sheets	893	921	950
Wire, plain	2,649	2,778	2,900
Lead, metal:			
Primary	400	r 420	440
Secondary	80	r 85	90
Magnesium, metal, including secondary	40	r 42	45
Manganese ore [2]	7,175	r 6,564	7,000
Mercury, metal, including secondary—76-pound flasks	45,000	45,000	47,000
Molybdenum, mine output, metal content—metric tons	7,000	7,000	7,500

See footnotes at end of table.

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Table 1.—U.S.S.R.: Estimated [1] production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS—Continued			
Nickel, metal, including secondary	r 95	100	105
Platinum, thousand troy ounces	1,900	2,000	2,100
Silver, metal, including secondary, do	35,000	35,000	37,000
Tin, metal:			
Primary, long tons	25,000	26,000	27,000
Secondary, do	8,000	8,000	10,000
Titanium, metal	10	11	12
Tungsten concentrates, contained tungsten, metric tons	6,200	6,200	6,500
Zinc:			
Recoverable metal content of domestic ores	535	540	610
Metal:			
Primary	540	r 575	610
Secondary	60	r 65	70
NONMETALS			
Asbestos	769	820	960
Barite	260	260	280
Boron, materials and compounds, B_2O_3 content	68	69	70
Cement [2]	84,809	r 87,512	89,800
Kaolin (including china clay)	1,700	1,700	1,800
Corundum, metric tons	5,000	6,000	6,000
Diamond:			
Gem, thousand carats	1,400	1,400	1,500
Industrial, do	5,600	5,600	6,000
Total, do	7,000	7,000	7,500
Diatomite	360	360	360
Feldspar	240	240	250
Fertilizer materials:			
Crude:			
Nitrogen compounds, N content equivalent [3]	3,753	r 4,177	4,360
Phosphate:			
Apatite:			
Ore, 17.7 percent P_2O_5	21,200	r 24,000	25,000
Concentrate, 39.4 percent P_2O_5	8,800	r 9,700	10,500
Sedimentary rock:			
Ore, 13 percent P_2O_5	15,000	16,000	17,500
Concentrate, 19 to 25 percent P_2O_5	7,500	8,000	8,750
Potash, K_2O equivalent [3]	2,868	r 3,120	3,180
Manufactured: [3]			
Nitrogenous, bulk	18,305	r 20,375	21,650
Phosphatic, bulk	9,984	r 10,343	11,000
Potassic bulk	6,894	r 7,500	7,650
Phosphatic meal	4,776	5,169	5,550
Others	124	82	150
Total	40,083	43,469	46,000
Fluorspar	380	380	400
Graphite	65	70	70
Gypsum [2]	4,691	4,697	4,700
Lime, dead burned [2]	19,651	20,716	21,000
Magnesite	3,000	3,000	3,100
Mica	35	36	37
Pyrite:			
Gross weight	3,500	3,500	3,500
Sulfur content	1,850	1,850	1,850
Refractories: [3]			
Shamotte	6,075	6,080	6,100
Dinas (quartzite-lime)	637	630	650
Magnesite and chrome magnesite	1,424	1,443	1,450
Magnesite powder	1,320	1,352	1,350
Total	9,456	9,505	9,550
Salt, all types [3]	10,600	11,000	11,500
Sulfur (excluding sulfur content of pyrite)	1,500	1,500	1,600
Talc	370	370	380

See footnotes at end of table.

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Table I.—U.S.S.R.: Estimated [1] production of mineral commodities—Continued
(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969
MINERAL FUELS AND RELATED MATERIALS			
Coal: [6]			
Brown [2]	143,815	138,299	140,000
Hard:			
Coking [2]	147,623	154,498	161,000
Anthracite [2]	77,139	76,896	78,000
Undifferentiated	r 226,660	224,277	229,000
Total hard coal	r 451,422	455,671	468,000
Total [2]	595,237	593,970	608,000
Coke, oven and beehive [2]	69,897	71,505	73,500
Crude oil [2]	288,068	309,150	328,000
Fuel briquets	6,787	6,976	7,100
Oil shale [2]	21,601	21,868	22,000
Peat, agricultural use	130,000	130,000	130,000
Peat, fuel use [2]	r 60,200	r 50,000	60,000
Natural gas [2] billion cubic feet	5,601	6,039	6,455
Electric power [2] billion kilowatt hours	588	638	689

r Revised.
[1] Estimate except where noted.
[2] Reported in Soviet sources.
[3] Data for 1967, United Nations Quarterly Bulletin of Steel Statistics for Europe. V. 19, No. 1, 1968, p. A-23; for 1968, No. 2, 1969, p. A-23. Data for 1969 are preliminary.
[4] Items listed under this heading are produced from semimanufactures listed above and possibly also from imported materials. Therefore, these data are not additive to the total of semimanufactures listed.
[5] Run-of-mine coal; the average ash content of the coal shipped from the mines was 19.7 percent and average calorific value was a little more than 5,000 kilocalories per kilogram in 1969.

TRADE

Tables 2 and 3 are derived from official statistics of the Ministry of Foreign Trade for 1968 and partially for 1969. Official detailed figures by country for 1969 are not yet available, but the same general pattern can be expected.

Soviet foreign trade continued to be oriented toward the importation of needed production machinery and equipment, including complete industrial plants. Exports of minerals produced foreign exchange to help pay for imports even though most minerals exported could be consumed within the country.

The value of total Soviet trade expanded from 18.0 billion rubles in 1968 to 19.8 billion rubles in 1969. Exports and imports were each about 9.7 percent higher in 1969 than in 1968. The value of total Soviet trade with various groups of countries in 1969 follows, in billion rubles:

CMEA countries [1]	11.2
Other Communist countries	1.7
Total Communist countries	12.9
Developed non-Communist countries	4.4
Developing non-Communist countries	2.5
Total non-Communist countries	6.9
Total Soviet trade value	19.8

[1] CMEA (CEMA)—Council for Mutual Economic Assistance—comprising the following countries: Bulgaria, Czechoslovakia, East Germany, Hungary, Mongolia, Poland, Rumania, and the U.S.S.R.

Almost two-thirds of Soviet foreign trade was transacted with Communist countries. The largest turnover was achieved in trade with East Germany (more than 3 billion rubles), Poland (2.1 billion), Czechoslovakia (2.0 billion), and Bulgaria (1.8 billion rubles). The trade turnover with North Vietnam increased during 1969 by almost 17 percent from 159 million rubles to 186 million rubles. This increase was achieved mainly through an increase in Soviet deliveries. Trade was maintained at a high level with Cuba—770 million rubles; Yugoslavia—425 million rubles; and North Korea—295 million rubles. There was a further reduction in trade turnover with mainland China from 86.4 million rubles in 1968 to 51.1 million in 1969.

In recent years, the Soviet Union has been developing its trade with the United Kingdom, Finland, France, Japan, Italy, Austria, Sweden, and a number of other non-Communist developed countries. In 1969, the United Kingdom was the western country with the largest trade turnover (600.5 million rubles) with the U.S.S.R., followed by Japan (558.7), Finland (500.8), West Germany (496.8), Italy (493.5), France (417.4), the Netherlands (232.0), and the United States (159.6 million rubles).

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The 1969 agreement between the Soviet Union and the United Kingdom provides for further expansion of trade during 1969–75. Soviet economic ties with Japan on trade and payments after 1970 and the problem of joint development of Soviet natural resources was being studied. The Soviet Union's relations with Italy were developing on the basis of a long-term agreement for 1966–69, which envisages the growth of trade. Finally, in 1969, the Soviet Union and France concluded an agreement on commercial collaboration for 1970–74, which contained provisions for a twofold increase in trade.

Trade turnover with the developing countries grew through the expansion of economic and technical assistance to these countries. The U.S.S.R. has concluded agreements for economic and technical cooperation with about 35 Asian, African, and Latin American countries. Among the developing countries, the United Arab Republic (U.A.R.) was the Soviet Union's largest trading partner. By 1969, trade turnover between the U.S.S.R. and the U.A.R. increased by 26.5 percent to 419.7 million rubles. Trade with India increased by 7.2 percent; with Iraq by 31.8 percent; with Iran by 70 percent; with Malaysia by 22.7 percent; with Syria by 35.1 percent; with Algeria it doubled; with Morocco by 46.4 percent; and with Congo (Brazzaville) by 45.6 percent. The developing countries share of the Soviet foreign trade total volume was almost 13 percent in 1969.

According to Soviet official sources, 32 countries on three continents were being helped in mineral prospecting by Soviet geologists. Oil exploration, development of producing and undeveloped fields, and studies for utilization of associated gas were included in the Soviet contracts with developing countries of Africa and the Near East.

Fuel, mineral raw materials, the metals continued to play the greatest role in Soviet exports. In 1969, 36.9 percent of the total officially recorded Soviet exports fell into this group of commodities. Official foreign trade statistical reviews do not include exports of precious metals. The annual total value of known exports of these metals, as measured by recorded imports of other countries, has been consistently high, not withstanding an appreciable annual fluctuation.

In 1969 the Soviet Union exported 90.8 million tons of crude oil and petroleum products, 4.6 million tons more than in previous years. The annual increase in deliveries of these commodities to CMEA countries reached 5.5 million tons. There was also an increase in the export of iron ore (from 32.1 to 33.1 million tons, of which 29.1 million tons went to CMEA countries), ferrous rolled metal products (from 5.5 to 6.5 million tons), pipes (from 294,000 to 328,000 tons), and nonferrous metals (from 394 to 511 million rubles). There was also an increase in exports of coal, manganese, and chrome ores, pig iron, asbestos, apatite concentrates, and cement.

Most of the U.S.S.R.'s 1969 export trade in minerals was with Europe and Japan. The United States share of mineral commodity exports was insignificant. Over 60 percent of the mineral trade, as a whole, remained within the CMEA countries. Soviet deliveries covered almost 100 percent of the import requirements of the European Communist countries in crude oil and pig iron, some 85 percent in iron ore, and about 75 percent of the requirements in mineral fertilizers in 1969. The relative dependence of East European countries on mineral product imports from the Soviet Union in their consumption in 1968 was as follows, in percent:

Country	Oil	Iron ore	Pig Iron	Rolled ferrous metal	Cement
Bulgaria	90	38	16	48	3
Czechoslovakia	97	79	6	6	5
East Germany	91	48	[1] 29	35	--
Hungary	64	82	13	15	16
Mongolia	86	--	100	100	44
Poland	97	77	13	6	2
Rumania	--	52	17	13	--

[1] 1965.

Source: "S.S.S.R. i zarubezhnye strany posle pobedy velikoy okyabrskoy sotsialisticheskoy revolyutsii" (The U.S.S.R. and Foreign Countries After the Great October Revolution). Moscow, 1970, p. 143.

The Soviet Union, the world's second largest producer of crude oil and petroleum products, was responsible only for about 5 percent of the world's international trade in these commodities. Net exports of crude oil and products were small, by world standards, and would be still smaller, if the net exports to CMEA countries are excluded.

The most important categories of mineral commodity imports in 1969 were ferrous and nonferrous semimanufactures,

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steel pipes, bauxite and alumina, tin, tungsten concentrate, barite, fluorspar, talc, and mica. There was an increase in the imports of ferrous rolled metals, reaching 1.6 million tons, and of pipes, from 765,000 tons to 1,043,000 tons. Purchases of nonferrous metals, which formerly occupied a notable place in Soviet imports, accounted for the relatively small sum of 71 million rubles. The U.S.S.R. is becoming an increasingly exporter of these commodities. In 1969 exports of nonferrous metals exceeded imports by 440 million rubles, compared with 325 million rubles in the previous year.

Soviet purchases of machinery and equipment accounted for approximately half of the imports from the United Kingdom and France, including complete equipment for a chemical industry complex. A considerable part of the imports from developing countries were goods delivered in payment for loans from the U.S.S.R. The U.S.S.R. received almost one-half of the entire export of machinery and equipment from CMEA countries, primarily from East Germany, Czechoslovakia, and Rumania.

U.S.S.R.'s mineral trade in recent years has been growing more rapidly than the rest of the world, and if the policies continue, it will expand in the years to come. Although most of its trade is presently conducted with other Communist countries, it is possible that for some mineral commodities (diamond and aluminum) the Soviet Union could assume major proportions in the world markets in the near future.

Table 2.—U.S.S.R.: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1968
METALS			
Aluminum:			
Ingots and equivalent primary forms	287,600	320,000	East Germany 84,900; Czechoslovakia 44,800.
Semimanufactures, including those of duraluminum	79,500	102,800	East Germany 15,600; Czechoslovakia 14,859.
Antimony, primary forms	800	1,200	Bulgaria 401; Netherlands 300; Japan 43.
Cadmium, primary forms	700	700	East Germany 185; Czechoslovakia 163.
Chromite (48 to 56 percent Cr_2O_3)	1,048,000	1,144,000	United States 326,000; Japan 160,000 Sweden 123,000; West Germany 108,000; France 90,000.
Copper:			
Ingots, equivalent primary forms:			
Unalloyed	109,300	107,400	East Germany 43,800; Czechoslovakia 32,400.
Alloyed (bronze)	5,700	4,800	East Germany 1,900.
Semimanufactures:			
Unalloyed	7,900	8,200	Cuba 4,039; Czechoslovakia 1,609; Rumania 948.
Alloyed (copper-zinc)	3,800	7,000	Cuba 1,051; Bulgaria 983.
Ilmenite	14,800	NA	
Iron and steel:			
Iron ore—thousand tons	32,201	33,071	Poland 9,990; Czechoslovakia 9,533; Rumania 3,138.
Pig iron—do	4,522	4,691	Poland 938; Japan 749; East Germany 701.
Ferrous scrap—do	664	1,325	East Germany 158; Japan 87; Sweden 73; Finland 64.
Ferroalloys:			
Ferrosilicon	111,800	118,400	Rumania 70,100; Czechoslovakia 64,300; Hungary 36,800; Netherlands 32,400; United Kingdom 23,100.
Ferromanganese	97,200	107,500	
Ferrochromium	33,300	37,800	
Ferrovanadium	2,000	1,400	
Vanadium slag	41,700	34,600	
Not specified	26,400	27,400	
Total	312,400	327,100	
Semimanufactures:			
Rolled products, excluding pipes—thousand tons	5,472	6,459	East Germany 1,809; Bulgaria 645; Rumania 571.
Steel pipes—do	294	328	East Germany 121; Bulgaria 62; Cuba 30.
Lead, ingots and equivalent primary forms	90,900	97,900	East Germany 41,400; Czechoslovakia 25,200; Hungary 10,600.

See footnote at end of table.

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Table 2.—U.S.S.R.: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1968
METALS—Continued			
Magnesium, primary forms	14,500	15,000	Netherlands 8,300; East Germany 1,901.
Manganese ore:			
Metallurgical grade	1,150,000	1,197,000	Poland 318,000; Czechoslovakia 177,000; East Germany 108,000.
Battery and chemical	19,000	18,200	Netherlands 10,200; East Germany 2,600.
Zinc, ingots and equivalent primary forms	78,700	97,400	East Germany 38,100; Czechoslovakia 16,800.
NONMETALS			
Abrasives, hard alloys	89	143	Bulgaria 15; Finland 14; Hungary 11.
Asbestos	303,700	346,500	France 40,200; West Germany 38,800.
Cement—thousand tons	2,641	2,959	Hungary 504; Poland 284.
Cryolite	5,400	5,400	Poland 1,500; Hungary 900.
Fertilizers and fertilizer raw material:			
Apatite ore	60,500	47,300	Czechoslovakia 27,800.
Apatite concentrates 38.5 to 39.4 percent P_2O_5—thousand tons	5,107	5,608	East Germany 1,083; West Germany 823.
Superphosphate, not less than 18.7 percent P_2O_5	445,600	443,100	Hungary 135,500; Bulgaria 88,300; Cuba 15,300.
Ammonium nitrate	197,900	151,400	Cuba 55,400.
Ammonium sulfate	749,100	787,000	Cuba 231,600; India 176,300.
Potassium salts, KCl 41.6 percent K_2O equivalent	1,721,500	1,678,500	Japan 291,900; Belgium 197,700; Hungary 164,600.
Graphite	10,200	12,100	Poland 3,200; East Germany 2,500; Hungary 1,300.
Gypsum	9,100	NA	All to Finland.
Kaolin	13,500	NA	NA.
Pyrite—thousand tons	1,532	1,533	Italy 740; East Germany 252.
Refractories:			
Clay, fire resistant	23,800	35,300	Poland 16,600; Hungary 5,500.
Other	118,200	125,200	Bulgaria 45,400; Poland 14,300.
Salt	275,400	222,000	Czechoslovakia 109,800; Hungary 51,600; Finland 43,200.
Sulfur	291,200	362,500	Cuba 97,600; Hungary 96,100; Czechoslovakia 55,100.
Sulfuric acid	182,500	155,600	Czechoslovakia 68,300; Hungary 44,800.
Talc	16,600	NA	All to Japan.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	28,400	39,100	East Germany 7,200; Czechoslovakia 3,900; Hungary 3,720.
Coal:			
Anthracite—thousand tons	8,198	4,045	France 1,169; Czechoslovakia 285; Italy 231.
Bituminous—do	17,939	19,194	Bulgaria 3,422; Japan 2,645; East Germany 2,640; Czechoslovakia 2,224.
Other—do	113	60	All to Czechoslovakia.
Total—do	21,250	23,299	
Coke—do	3,824	3,996	East Germany 1,271; Rumania 729; Hungary 595; Finland 584.
Gas, natural—million cubic meters	1,729	2,664	Poland 1,000; Austria 142.
Petroleum:			
Crude—thousand tons	59,216	63,887	
Refinery products:			
Gasoline—do	3,352	3,324	
Kerosine—do	1,321	1,473	
Gas, diesel oil—do	10,089	9,949	Italy 11,865; Czechoslovakia 8,380; East Germany 7,553; Finland 7,526; Poland 7,124; West Germany 5,950; Bulgaria 5,499; Cuba 5,303.
Residual fuel oil—do	11,682	11,589	
Lubricants—do	299	324	
Bitumen—do	38	37	
Paraffin—do	24	28	
Unidentified—do	194	188	
Total—do	26,999	26,912	
Power, electric million kilowatt-hours	2,470	3,939	Hungary 1,914; Poland 291.

NA Not available.

Sources: 1. Vneshnyaya torgovlya SSSR za 1968 god (Foreign Trade of the U.S.S.R. for 1968 Year). Moscow, 1969, 300 pages. 2. Vneshnyaya torgovlya. Moscow, No. 7, July 1970, pp. 49–58.

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Table 3.—U.S.S.R.: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1968
METALS			
Aluminum:			
Bauxite	1,177,900	NA	Yugoslavia 721,800; Greece 456,000.
Alumina	387,500	595,800	United States 193,500; Hungary 147,900; Greece 28,100.
Semimanufactures, including those of duraluminum	2,200	1,500	NA.
Cadmium, primary forms	235	217	Poland 200.
Copper, ingots and equivalent primary forms:			
Unalloyed	9,400	400	NA.
Semimanufactures	6,700	11,000	All from Yugoslavia.
Iron and steel:			
Pig iron—thousand tons	63	48	All from North Korea.
Ferroalloys—do	9	7	North Korea 2.
Rolled products, excluding pipes—do	1,362	1,602	Rumania 226; West Germany 216; France 125; Austria 98.
Steel pipes—do	765	1,048	Rumania 155; Sweden 79; Japan 75.
Lead:			
Ore	45,300	NA	All from Iran.
Ingots and equivalent primary forms	39,100	24,800	North Korea 19,100; Yugoslavia 16,800.
Mercury—76-pound flasks	3,900	NA	All from Yugoslavia.
Tin, primary forms—long tons	7,100	6,800	United Kingdom 5,200; Malaysia 1,200.
Zinc:			
Ore	20,000	10,600	All from Iran.
Concentrate	18,100	NA	All from North Korea.
Dust	2,200	NA	All from Poland.
Ingots and equivalent primary forms	36,400	50,100	Poland 27,900; North Korea 4,600.
Rolled products	800	3,800	All from Poland.
Alloys	3,900	4,100	All from Poland.
NONMETALS			
Barite	179,800	142,700	North Korea 88,900; Yugoslavia 34,300; Bulgaria 27,500.
Cement—thousand tons	295	378	All from North Korea.
Fluorspar	102,000	134,100	Mongolia 67,500; mainland China 31,900.
Mica	160	417	All from India.
Refractories, magnesite powder	211,400	276,200	All from North Korea.
Sulfur	9,400	24,800	NA.
Talc	50,800	82,700	North Korea 28,700.
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous—thousand tons	6,900	7,200	Mostly from Poland.
Coke—do	658	659	All from Poland.
Petroleum refinery products:			
Gasoline—do	694	644	NA.
Kerosine—do	7	106	
Gas, diesel oil—do	186	175	
Residual fuel oil—do	32	21	
Lubricants—do	96	114	
Bitumen—do	22	24	
Paraffin—do	6	7	
Unidentified—do	22	37	
Total—do	1,065	1,128	Rumania 685; East Germany 285.
Carbon black	1,700	6,400	Rumania 1,200.

NA Not available.

Sources: Vneshnyayatorgovlya SSSR za 1968 god (Foreign Trade of the U.S.S.R. for 1968). Moscow, 1969, pp. 300. Vneshnyaya torgovlya. Moscow, No. 8 August 1970, pp. 49–58.

COMMODITY REVIEW

METALS

Development of ferrous and nonferrous metal industries lagged behind goals foreseen in the 1966–70 5-year plan; however, production of metals and alloys continued to grow. Beneficiation and metallurgical facilities still experienced poor metal recoveries; for example, the nonferrous industry of Kazakhstan recovered only 50 to 65 percent of the total value of the components from the ore. From 50 to 80 percent of rare and dispersed elements, 50 to 65 percent of combined sulfur, 8 to 16 percent of copper, 10 to 12 percent of lead, and 11 to 12 percent of zinc were discarded in tailings in 1969.[15]

[15] Narodnoye Khozyaystvo Kazakhstana (National Economy of Kazakhstan). Alma-Ata, No. 9, September 1969, p. 83.

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At lead-and-zinc plants the extraction of rare metals as byproducts was not at designed levels. Only 40 percent of the total lead tailings were processed for rare and precious metals recovery, and there was no processing of residues from copper smelting. There were high losses of metals in stack gases because of inadequate dust-collecting equipment.[16]

Utilization of machinery and equipment was considerably below the planned levels and modernization, and replacement of obsolete equipment was slow. As a result, productivity even at advanced enterprises in Kazakhstan's nonferrous industry was lower than that of comparable enterprises in the United States and Canada. Many mining machines had low durability and wore out quickly and the organization of repair and maintenance operations was poor.[17]

Aluminum.—The Soviet Union, operated 13 primary reduction plants with a total probable capacity (January 1, 1970) of 1.4 million tons. Although exact production figures are not available, it is believed output of primary metal was about 1.05 million tons in 1969.

The aluminum supply position in 1969 was as follows in thousand metric tons:

Production of primary aluminum	1,050
Production of secondary aluminum	120
Imports of aluminum (ingots)	-----
Exports of aluminum (ingots)	320
Apparent consumption	850

The U.S.S.R. was a large producer of low-grade bauxite, and other aluminous raw materials. However, supplies were insufficient; therefore, over 1.2 million tons of high-grade bauxite and about 0.6 million tons of alumina were imported from Hungary, Yugoslavia, Greece, and the United States in 1969.

In 1969, attention was given to improving the raw material base and to erecting alumina plants to close the gap between productive capacity for aluminum and alumina. Deficits of aluminum ore in the U.S.S.R. may be reduced in the next few years if development of nepheline deposits in Siberia is successful. The importance attached to developing nepheline sources was emphasized by a 44-percent increase in funds for prospecting of aluminous raw materials in 1970, compared with 1969.

The Northern Urals was the main bauxite and alumina-producing area in the Soviet Union in 1969. Three new underground mines were scheduled for completion in 1970.

Output of bauxite in Kazakhstan, the Soviet Union's second most important aluminum raw material source increased in 1969. Development of the Turgay open pits, slowed by investment delays continued although bauxite output was only 60 percent of the planned 1969 quota. The capacity for alumina production at the Pavlodar aluminum plant, however, was already approaching the planned level.

Development of bauxite deposits at Krasnyoktyabrskoye and Belinskoye in north Kazakhstan, and at Iksinskoye in Arkhangel region, was scheduled between 1971 and 1975.

The Achinsk alumina plant in West Siberia, which will be the principal plant producing alumina from nepheline, and which will provide alumina for the Krasnoyarsk aluminum plant, was about to be commissioned. Small alumina plants using nepheline were also under construction at Pikalevo (plant No. 2), Ul'yanovsk and Mikhaylovsk.

The Yerevan aluminum plant in Armenia was the first Soviet enterprise to produce aluminum wire and foil direct from liquid metal in 1969. An experimental alumina installation was also completed at the Almalyk metallurgical complex in Uzbekistan; it will be used to plan future alumina enterprises, one of which will be based on kaolin deposits at Angren.

A new potline was put into operation at the Bratsk aluminum plant on December 12, 1969. Meanwhile, construction continued on the Bratsk, Krasnoyarsk, Irkutsk, and Tadzhik aluminum plants.

Antimony.—Deposits of antimony occur at Kadamzhay in Kirgiz S.S.R., Turgay in Kazakhstan, and at Sarylakh and Tazhdolinsk in Siberia. Kadamzhay remained the principal antimony center of the U.S.S.R., and its integrated facilities produced most of the country's refined product. During 1966–70, it is planned to increase antimony output in Kirgiz S.S.R. by 50 to 100 percent, by renovating the Kadamzhay works as well as the Tereksay mine. The Dzhidzhikrutskiy mining and concentration combine in Tadzhikistan, construction of

[16] Narodnoye Khozyaystvo Kazakhstana (National Economy of Kazakhstan). Alma-Ata, No. 4, April 1969, pp. 24-29.

[17] Narodnoye Khozyaystvo Kazakhstana (National Economy of Kazakhstan). Alma-Ata, No. 4, April 1969, pp. 24–29.

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which started in 1967, will be the main Soviet supplier of antimony and mercury after 1970.

Beryllium.—The Soviet Union continued to be one of the world's largest producers and consumers of beryl, beryllium alloys, and metal. There are numerous beryl deposits in the U.S.S.R., mainly in the Asian part of the country, and on the Kola Peninsula.

The beryllium production schedule was being speeded up. According to the 1966–70 5-year plan, output may be increased by 50 to 60 percent, indicating a probable production level of 1,500 to 1,600 tons of beryl (10 to 12 percent BeO) by 1970.

Bismuth.—As in 1968, bismuth was produced in 1969 almost entirely from complex ores, such as tungsten-molybdenum-bismuth ores of the North Caucasus, and scheelite and cassiterite ores of Kazakhstan and Siberia. In 1969, a deposit of bismuth was discovered in the northern spur of the Sikhote-Alin Mountains of Maritime Kray. The new deposit is located near the Krasnorechenskiy mining combine.

Chromium.—The U.S.S.R. continued to be the world's leading producer and exporter of chromite in 1969. Exports totaled 1,144,000 tons during the year, with about 90 percent destined for non-Communist countries. Approximately one-third of the output was consumed or stocked in the Soviet Union. Based on 1964–69 data, Soviet consumption of chromite was distributed as follows: Metal production, 45 percent; refractories, 32 percent; and chemicals and other products, 23 percent. Estimated data on production, consumption, and exports of chromite in 1968–69 and 1970–80 are summarized in the following tabulation in thousand metric tons:

Item	1968	1969	Planned and estimated		
			1970	1975	1980
Production (30 to 56 percent Cr_2O_3)	1,270	1,700	1,750	2,000	2,250
Consumption and stocks (30 to 56 percent Cr_2O_3)	522	556	600	700	800
Exports (48 to 56 percent Cr_2O_3)	[1] 748	1,144	1,150	1,300	1,450

[1] Reported in Soviet sources.

The tonnage of chromite ore mined in the U.S.S.R. in 1969 was more than twice that mined in 1958; a further increase of 50 percent was expected by 1975. The Donskoye mining operations at Khrom-Tau in western Kazakhstan accounted for 90 percent of Soviet output and was the only source of high-quality ore in the country. Most of the ore was of sufficiently high grade to be shipped without beneficiation other than hand-picking. Reserves of high-grade ore also were found in the Ural Mountains. About 20 additional deposits of chromite have been discovered and explored since 1966.

At Donskoye, a concentrating mill for producing 300,000 tons of chromite concentrates per year was under construction in 1969. The plant, the first of its type to be built in the Soviet Union, is designed to process 1 million tons of crude ore annually.

Cobalt.—In 1969 cobalt was produced at Norilsk in West Siberia; at Monchegorsk and Pechenga on the Kola Peninsula; in the Urals at the Yuzhuralnikel', Ufaley, and Rezhsk nickel plants; and also at some copper plants. Production facilities at the Khovu-Aksinsk arsenic-cobalt deposits in the Tuva republic were under construction, with initial production scheduled for 1970. At Monchegorsk, cobalt production was increased by the installation of larger-capacity electric furnaces, and there were also improvements in ore flotation and metal extraction.

Mine reserves were estimated at 100,000 tons of contained cobalt, chiefly in nickel ore.

Copper.—The Soviet Union remained among the world's largest producers and consumers of copper. The estimated 6-percent increase in output of primary metal in 1969 was due to initial ore production from new mines in Kazakhstan (Balkhash, Dzhezkazgan, and Boshchekul); in the Urals (Gay, and Uchaly); and in Armenia, Norilsk, and Siberia. The Balkhash mining and metallurgical complex was the largest single producer of copper and rhenium.

Consumption of refined copper was around 750,000 tons in 1969. Exports declined by 1,900 tons and imports declined by 9,000 tons, compared with 1968 levels.

Copper production schedules were being accelerated. According to the 5-year plan

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(1966–70), Soviet copper output was to increase to 1.1 or 1.2 million tons of primary copper in 1970. Actual output may be 10 to 20 percent less. Output may reach 1.4 million tons by 1975 and 1.9 million by 1980. The increase in production depends primarily upon expansion in Kazakhstan and Uzbekistan, where mechanized large-scale operations are being developed.

Gross copper reserves of the U.S.S.R. were estimated at 35 million tons of contained metal, chiefly in low-grade sandstone and porphyry deposits in districts where many ore bodies are suitable for opencast mining. The reserves include several million tons of copper in high-grade, pyritic ores containing other metals, and a smaller quantity in ores of vanadium, titanium, and other metals. Over half of the reserves were situated in Kazakhstan.

The cut-off percent for copper in Soviet mines ranged from 0.4 percent at the Kounrad open pit, to 1 percent at underground mines in the Urals. About 82 percent of all copper was mined by opencast methods in 1969, and the use of this method is increasing.

The Urals region was the main center of copper production in 1969. Output of blister copper at the Mednogorsk combine increased by 20 percent. In Orenburg Oblast', the second stage of the Gay mining and concentrating combine was completed, and a third copper deposit was discovered in the Dombrovskiy Steppe area.

In Kazakhstan, the second largest copper-producing region, construction of the Dzhezkazgan metallurgical complex continued. Completion of the first stage of the complex was delayed, and was rescheduled for 1970. Two underground mines were operating and two more were under development. At the Boshekul copper deposits in Pavlodar Oblast', Kazakhstan, construction of a large mining combine was scheduled to begin in 1970. At the Balkhash works, the first exports of copper wire bar began in 1969, and a rolling mill will soon be installed.

In Armenia, mining began early in 1969 at the Davartskiy open pit of the Kafan mining combine. At the Alaverdy copper works, production of blister copper and refined copper reportedly increased by 31 percent and 28 percent, respectively, compared with 1968.

At the Norilsk metallurgical complex the No. 2 copper electrolysis plant was nearing completion and No. 3 was under construction.

In Georgia, a mining and concentrating combine, scheduled to begin operations in 1972, was under construction at Madneuli. The combine will produce complex nonferrous ores. In Uzbekistan, the country's largest plant for casting and rolling of copper began operating. In East Siberia, the U.S.S.R. was negotiating with Japanese, French, and British companies to develop the Udokan copper deposits northeast of Lake Baykal.

Gold.—The 1969 production of gold was estimated at 6,250 thousand troy ounces. The growth of Soviet gold production was reported to result from expansion of placer mining in Siberia.

According to statistics of the International Monetary Fund, Soviet sales of gold in western markets during the past 10 years were as follows, in million dollars:

1958	220	1963	550
1959	250	1964	450
1960	200	1965	550
1961	300	1966	29.5
1962	215	1967	15.0

Soviet sources reported that proved gold reserves are sufficient for 16 to 17 years of operation at present rates of production. Reserves of gold in underground and placer deposits were estimated at about 200 million ounces in 1969.

Extension prospecting for gold was being carried out in the Asian part of the country. Discovery of several vein deposits was reported in 1969, in Kazakhstan, Siberia, Central Asia, and the Transcaucasus. New placer deposits reportedly were found at Chukotka and other regions of the Soviet Far East and Yakutia. Gold reportedly was discovered for the first time in the Transcarpathian region of the Ukraine.

The principal gold producing areas of the U.S.S.R. were the Soviet Far East, East Siberia, West Siberia, the Urals, and Kazakhstan. Reportedly, about three-quarters of metal production came from the subarctic area of Asia, (mainly from placer deposits at Kolyma, Aldan, Indigarka, Yana, and Chukotka); most of the remainder came from gold and plymetallic ores mined in Siberia, the Urals, Kazakhstan, and Armenia. Alluvial deposits contributed about 67 percent of total 1969 output.

Magadan Oblast' was the main center of gold production, where 32 placer mines, 18 dredges, and more than 100 sandwashing rigs were in operation in 1969. Roughly 35

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percent of the gold came from mines developed in the last 5 or 6 years. The first railroad was built on permafrost in the Omchaksk Valley, and is designed for the transportation of gold-bearing rock from the new Matrosov mine. The Matrosov mine was the only mine in the Oblast' that produced gold throughout the year. The Srednekan and Semiletka placer mines were merged in a new combine, the second such enterprise in the Oblast'. Previously, the Polyarnyy combine had consolidated operations of the Polyarnyy and Leningrad mines.

In the past 10 years, gold output in Chukotka (Magadan Oblast') has increased by 44 percent, but despite discovery of new gold deposits, production increases were slow owing to the lack of power and suitable equipment. Gold extraction in the Oblast' is to be increased by 5.5 percent in 1970 over 1969 level.

Climatic conditions peculiar to northeast U.S.S.R., caused difficult problems in mining, transportation, and maintenance of equipment. In Magadan Oblast', during a single season up to 40 percent of the parts of the 210-liter dredge from the Irkutsk Heavy Machinery Plant had to be replaced, and the cost of repairing bulldozers and tractors was almost twice as high as the initial cost of the equipment.[18]

Over 40 small dredges were in operation in the lower reaches of the Amur River. A gold (placer) mine began production in Tugur-Chumikan area near the Sea of Okhotsk.

The output of gold in Yakut A.S.S.R., in 1969 increased over 3 percent, compared with 1968. Approximately 165 washng rigs and about 450 bulldozers were operated. A concentration mill at the Pobeda placer mine was commissioned in August. Prospecting of the Sarylakh gold-antimony deposit was continued; the ore is to be processed by the Karamzhay combine in Kirgizia.

About 50 small dredges of the Transbaykal Gold Trust in Chita Oblast' were operated in 1969. Gold was also mined at Darasun, where two new mines (Yugozapadnaya and Sosnovsk) were under development in 1969, with initial production scheduled by yearend 1970.

Fifteen dredges were operated in the Bodaybo region of Irkutsk Oblast'. Reportedly, the largest electric dredge in the world was put into operation at the Marakan River in November. The dredge, constructed by the Irkutsk Heavy Machinery Plant, is 235 meters long, 46 meters wide, and is equipped with 170 buckets of 600-liter capacity. It reportedly will be able to operate to a depth of 50 meters, and to mine 2 million cubic meters of sand during a single season.

The Kazakh Gold Trust planned to increase gold output by 8 percent in 1970. The 890-meter Novaya shaft, the deepest in the Soviet Union, was being sunk at the Bestube mine in Tselinograd Oblast'. A plan for developing the new Yubileynoye gold deposit, recently discovered in the Aktyubinsk Steppe of Kazakhstan, was approved, and construction began on an open pit mine and concentrating plant.

At the old Miass placer area in the Urals, the new Svetlinskiy placer mine was commissioned in January. In Uzbekistan, first stage of the Kochbulak mine and mill of the Zarafshan combine, the leading gold mining enterprise of the republic, was also completed in January. The Chadak, Bichanzor, and Karakutan open pits were also under development in 1969. In Armenia, a mine and an experimental concentration mill were under construction at Zod.

The newly formed Tadzhikzoloto (Tadzhik gold) prospecting and exploitation trust began production of gold from deposits at Tobasmara and on the banks of Lake Iskander-Kul. Development of two other enterprises began at Yakh-Su and Tokar, and a 380-liter dredge was being installed at Yakh-Su.

Iron Ore.—In 1969, the Soviet iron ore industry operated 70 underground mines and 58 open pits with a total annual capacity of about 225 million tons of usable ore. About 78 percent of the production was from open pits and the remainder was from underground mines. About half of all underground mines had annual production capacities of less than 1 million tons of crude ore, and only 6 percent had capacities exceeding 4 million tons. About 20 percent of the open pits had annual production capacities exceeding 5 million tons. Annual production capacity for crude ore was increased by 15.9 million tons in 1969, compared with a planned increase of 38.2 million tons. The target for 1970 is 45.1 million tons of crude iron ore. Concen-

[18] Sovetskaya Rossiya (Soviet Russia). Moscow, Mar. 6, 1969, p. 2.

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trates were produced in 90 beneficiation plants, of which 29 had sintering facilities. Ouput of pelletized concentrate was 9.4 million tons in 1969 and it was expected that 11 million tons would be produced in 1970.

The increase in production over that of the previous year is shown in the following tabulation, in million tons:

Item	1968	1969	1969, as percentage of 1968
Iron ore (usable)	176.6	185.2	104.9
Sinter	128.2	132.9	103.7
Pellets	7.2	9.4	130.6

The average iron content was 33.4 percent in crude ore and 58.4 percent in usable ore (including concentrate). Iron content of direct-shipping ore averaged 54 to 55 percent in 1969, and that of concentrates averaged about 61 percent. The average grade of all ore mined (crude and direct shipping) was 38.4 percent.

Production of usable iron ore is slated to rise to 193 million tons in 1970; estimated levels for 1975 and 1980 are 235 and 280 million tons, respectively.

As of January 1, 1969, minable iron ore reserves of all categories in the U.S.S.R. totaled 109,700 million tons with an average iron content of 34.8 percent. Proved reserves were estimated at 6,000 million metric tons in about 120 deposits. Additional iron ore deposits were reportedly discovered in 1969 at Petrovskoye in Krivoy Rog, at Korelichi in Belorussia, and at Yakovlevo in Belgorod Oblast'.

The Ukraine produced 105 million tons of usable iron ore in 1969, of which Krivoy Rog basin accounted for about 95 percent. This basin supplies about 50 million tons of concentrates per year from an output of 120 to 150 million tons of low-grade ores. The fourth section of the second stage of the Ingulets GOK's concentrator was put into operation in December, and two more sections were under construction in 1969. The final two sections of the Severneyy concentrator (27 and 28) were also under construction. The Artem No. 2 mine, Rodina, and a new underground mine at the Karl Libnekht deposit is this basin were being developed in 1969. The first stages of the Denprovskiy and Zaporozhskiy iron ore combines in the Ukraine were scheduled for completion in 1970.

In 1969, the Urals was the second-ranking center of Soviet iron ore production, followed by Kazakhstan, West Siberia, the Kursk region, and the Kola Peninsula.

Future expansion of iron ore production will concentrate on the deposits in the Northwest and in Siberia. Nationwide pelletizing capacity was planned to reach 30 million tons per year in 1975. Increased exports of iron ore were planned to West European and Japanese markets.

Iron and Steel.—In 1969, compared with production in 1968, the U.S.S.R. produced 2.8 million tons more pig iron, 3.5 million tons more steel, 2.3 million tons more rolled ferrous metals and 0.3 million tons more steel pipe. Although production increased compared with 1968, the output of pig iron, steel, and rolled products did not fulfill planned quotas. Exports rose to 33.1 million tons of iron ore, 4.7 million tons of pig iron, and 6.5 million tons of steel. The U.S.S.R. steel trade was conducted largely with East European countries.

New facilities constructed in 1969 included two blast furnaces (at the Cherpovets and Nizhniy Tagil plants); eight oxygen converters (at the Chelyabinsk, West Siberian, Krivoy Rog, and Yenakiyevo plants); a blooming mill at the West Siberian plant; and coke batteries at Novolipetsk, Karaganda metallurgical, and Krivoy Rog coke-chemical plants. The additional capacity for pig iron was 3.3 million tons; for steel, 6.5 million tons, and for finished rolled products, 1.6 million tons. Facilities still under construction in 1969 included a blast furnace at the Yenakiyevo plant; two 250-ton oxygen converters at the Karanganda steel works; and a 100-ton oxygen converter at Chelyabinsk plant; one Martin furnace at the Amurstal' works; a "30–102" mill at the Nikopol' Southern pipe works; a mill at the West Siberian plant; and a pipe-welding mill at the Volga pipe plant. Several important planned construction projects for iron and steel were not completed in 1969. These include oxygen converters at the Chelyabinsk and Karaganda metallurgical plants; rolling mills at the Nikopol', West Siberian and Volga plants; blast furnace at the Yenakiyevo metallurgical plant; coke battery No. 8 at the Krivoy Rog plant; and many other installations.

The Karaganda metallurgical works, originally to be completed in 1964, was only half finished at yearend 1969. The estimated cost of the complex exceeded orig-

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inal estimates by 100 million rubles. Two blast furnaces, two coke batteries, 50 percent of sintering capacity, and 80 percent of steelmaking capacity have not been completed. Losses at Karaganda totaled 11.8-million-rubles in 1968 and 8.6-million-rubles during the first 6 months of 1969. The plant employed over 16,000 workers.[19]

The 1970 national plan envisages increases over 1969 production of 4.5 percent for pig iron (compared with planned 5.8 percent in 1969), 4.1 percent of steel (compared with 5.2), 4.5 percent for finished rolled metal (compared with 5.9), 6.3 percent for steel pipe (compared with 3.0), and 4.2 percent for iron ore (compared with 5.8 percent in 1969). It is planned to complete new facilities for production of 3,975,000 tons of pig iron, 3,850,000 tons of steel, 4,020,000 tons of finished rolled metal, 1,317,000 tons of steel pipe, 3,890,000 tons of coke, and 45,150,000 tons of raw iron ore. It is planned to invest 2,100 million rubles in 1970, or 5.8 percent more than was spent in 1969.

The centers of the iron and steel industry continued to be the R.S.F.S.R. and the Ukraine. Ouput of major commodities in these republics in 1969 were as follows, in million metric tons:

Product	R.S.F.S.R.	Ukraine
Iron ore	63.1	105.0
Pig iron	39.8	39.8
Steel	59.9	45.9
Rolled products	46.2	36.8
Steel pipe	6.6	4.0

Pig Iron.—Thirty-six enterprises operating 132 blast furnaces produced 81.6 million tons of pig iron in 1969, 3.6 percent more than in 1968. Iron production is slated to rise to 85 million tons in 1970; estimated levels for 1975 and 1980 are 104 million and 125 million, respectively. Average blast furnace capacity was reportedly about 1,050 cubic meters.

About half of all blast furnaces used oxygen for blast enrichment in 1969. Over 85 percent of pig iron was produced with the partial use of natural gas. Low-quality raw materials and irregular deliveries caused reduced output at several plants. As a rule, schedules for repairs were not observed.[20] The Nizhniy Tagil No. 6 blast furnace put into operation in 1969, experienced raw material shortages because iron ore mining, concentrating, and pelletizing facilities at the Kachkanarskiy combine had not become operational.[21]

Blast furnaces were under construction at the following plants: West Siberia (3,000-cubic-meter capacity, the largest in the U.S.S.R.); Karaganda (2,700 cubic meters); and at Yenakiyevo (1,386 cubic meters). All were scheduled for completion by year-end 1970.

Steel.—Seventy-six metallurgical works produced 110 million tons of steel in 1969, 3.3 percent more than in 1968; the 1970 target is 115 million tons. Estimated levels for 1975 and 1980 are 138 million and 160 million, respectively. Distribution of production by process follows, in percent:

Process	1967	1968	1969*
Oxygen converter	10.2	11.8	13.8
Electric steel	4.6	4.6	4.6
Open hearth	83.4	81.9	79.9
Bessemer	1.8	1.7	1.7
Total	100.0	100.0	100.0

* Estimate.

There were 25 oxygen converters (with an average capacity of 91 tons) and about 400 open-hearth furnaces (with an average capacity of 225 tons) in operation in 1969. Over 47 million tons of steel was produced by oxygen-assisted open-hearth units and 63.3 million tons of open-hearth steel was produced using natural gas. In 1969, 3.8 million tons of steel, 15 percent more than in 1968, was produced at continuous casting installations. There were small increases in the output of steel produced with the use of synthetic slags, in vacuum-melting, and by the electro-slag remelting process.

The share of steel produced in oxygen converters was relatively low, mainly because of limited automatic equipment for process-control. Existing oxyen-converter shops did not reach rated capacities. Their steel was more expensive than open-hearth steel; and labor productivity was lower than at open-hearth furnaces.

Because of pig iron shortages, the largest oxygen-converter shop in the U.S.S.R., the Yenakiyevs plant, did not operate at full capacity.[22]

[19] Narodnoye Khozyaystvo Kazakhstana (The National Economic of Kazakhstan). Alma-Ata, No. 9, September 1969, pp. 56–57.
[20] Rabochaya gazeta (Working Gazetta). Kiev, Mar. 13, 1970, p. 3.
[21] Pravda, Moscow, Jan. 20, 1970, p. 1.
[22] Sotsialisticheskaya industriya (Socialist Industry). Moscow, Dec. 14, 1969, p. 1.

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Soveit oxygen-converter statistics are shown in table 4.

In 1969, 100-ton electric furnaces were installed at the Cherepovets and Volgograd works. In September, a slag remelting furnace was completed in the new steel shop at the Izhora works.

About 36 percent of total steel output was based on scrap. Approximately 50 percent of the scrap came from steelworks, 22 percent came from metal fabrication plants, and the remainder was old scrap.

Rolled Products.—Output of rolled products (including finished rolled metal, pipes, forged ingots, and rerolling blanks), increased by 2.3 million tons to 87.5 million tons in 1969. Estimated levels of rolled products output for 1970, 1975, and 1980 are 91 million, 112 million, and 132 million, respectively.

Production of structural shapes remained inadequate. As planned output of rolled products is measured in tons, metallurgical plants prefer to produce heavy types of products and are reluctant to manufacture thin sheet and light sections because this reduces output and labor productivity. Moreover, many Soviet rolling mills were designed for single products, and cannot fulfill the planned product-mix quotas.

The hot-rolling mill at Novolipetsk, the No. 4 sheet cold-rolling mill at Magnitogorsk, the blooming mill at West Siberian, and a heavy section mill at the Orsk-Khalilovo steel plants were completed in December 1969.

Steel Pipe.—Reportedly, the Soviet Union was first among world producers of steel pipe. In 1969, a total of 11.5 million tons was manufactured, 3 percent more than in 1968. However, the industry did not satisfy the demands of all sectors of the Soviet economy, and around 10 percent of requirements had to be imported in 1969.

The deficit arose, because of the unbalanced production of some types of pipe, and customers involuntarily adjusted their requirements, taking not the pipe needed, but the pipe they were "given".[23] The largest pipe had a diameter of 1,220 millimeters. Pipe manufacture is slated to rise to 12.3 million tons in 1970; estimated levels for 1975 and 1980 are 15.5 million tons and 18 million tons, respectively. In 1969, welded pipe accounted for 56.5 percent of total pipe manufactured.

At the Karl Libkneht works in Dnepropetrovsk Ukraine, the first stage of the No. 4 mill to produce hot-rolled seamless pipes 125 to 325 millimeters in diameter, was under construction. At the pipe-rolling plant under construction in Volzhsk, Volgograd Oblast' two of the nine electric welding mills started production in 1969. The plant will produce spirally welded pipe in diameters from 530 to 1,420 millimeters. Equipment was supplied by Czechoslovakia, and 26 Czechoslovak engineers were helping with installation of this equipment. A new continuous pipe-rolling shop was being built at the Yuzhnotrubnyy Steel pipe plant in Nikopol' (Ukraine).

A pilot mill at the Novomoskovsk metallurgical works in Dnepropetrovsk Oblast' produced experimental pipe of 2,520-millimeter diameter, in sections 9 meters long and weighing 14 tons. This size pipe is intended for gas pipelines in Siberia and Central Asia. West Germany provided the equipment and technical assitance for this pilot plant. Experimental testing of the

[23] Pravda, Moscow, Mar. 6, 1969, p. 2.

Table 4.—U.S.S.R.: L-D oxygen steel shops, as of January 1, 1970

Plant	Location	Annual capacity (thousand metric tons)	Furnaces		
			Number	Output per furnace, per heat (metric tons)	Began operation
Petrovskogo	Dnepropetrovsk, Ukraine	600	3	30	1956-57
Krivorozhstal'	Krivoy Rog, Ukraine	1,200	3	55	1958
Krivorozhstal'	Krivoy Rog, Ukraine	4,200	5	100	1965-67-69
Zhdanov, Il'ich	Zhdanov, Ukraine	2,500	3	100	1964-66
Chelyabinsk	Chelyabinsk, Urals	1,700	2	100	1969
Yenakiyevo	Yenakiyevo, Ukraine	3,200	3	130	1968-69
West Siberian	Novokuznetsk, W. Siberia	2,500	3	100	1969
Novotagil'skiy	Nizhniy Tagil, Urals	2,500	3	100	1963-67
Novolipetsk	Lipetsk, Central European U.S.S.R.	2,500	3	100	1966-67
Total		20,900	28	XX	XX

XX Not applicable.

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large-diameter welded pipe indicated that it required further improvements.

According to an agreement, Czechoslovakia will each year deliver to the Soviet Union 202,000 tons of large-diameter seamless pipe for oil and gas transmission. Therefore, almost all of the output of the Khomutov pipe plant in Czechoslovakia will be shipped to the U.S.S.R. The Soviet Union was reported to have doubled its orders for Italian steel pipe from 0.5 to 1 million tons.

Ferroalloys.—The first stage of a plant for producing ferromanganese was commissioned at the Nikipol' ferroalloy plant in Dnepropetrovsk Oblast' (Ukraine) in January 1969. There are to be 12 electric furnaces in this shop.

With completion of the second stage of the Zestafoni ferroalloys plant in Georgia, it became the Soviet Union's leading plant for production of ferromanganese. The third stage was under construction in 1969, and is slated for commissioning in 1970. The Yermak ferroalloys plant in Kazakhstan began producing 25 percent ferrosilicon and ferromanganese. Two additional electric furnaces were put into operation at this plant in 1969.

Ferrous Metal Consumption.—The basic demand for ferrous metals in the Soviet economy came from four sectors-machine building and metal working, construction, railroad transporation, and the oil and gas industry. About 50 million tons of steel was consumed by the machine-building and metal working industries in 1969. According to Soviet estimates, consumption of metal per unit of product in the machine building industry was 25 percent higher than in the United States. Because of waste and unnecessary heavy machinery design, the Soviet economy loses about 12 million tons of steel per year.[24]

Soviet iron and steel statistics are presented in table 5.

Lead and Zinc.—The Soviet lead and zinc industry was probably the second largest in the world. Estimated output of primary metal in 1969 was 610,000 tons of zinc and 440,000 tons of lead. Ore reserves were estimated in 1969 at 17 million tons of contained lead and 22 million tons of contained zinc. Around 70 percent of the reserves are located in Kazakhstan, chiefly in the Altay region and in the district of Kara-Tau. Large reserves of zinc were also found in the Urals.

According to the 1966–70 5-year plan, Soviet zinc production in 1970 is to be 1.6 to 1.7 times that of 1965. Production of zinc in Kazakhstan was to be increased by 90 percent and that of lead by 40 percent. In 1969, Kazakhstan was the leading producer of lead and the second largest producer of zinc in the U.S.S.R. The Republic accounted for almost half of Soviet zinc production. Most of the lead and about 70

[24] Pravda, Moscow, Sept. 13, 1968, p. 2.

Table 5.—U.S.S.R.: Salient iron and steel statistics

(Million metric tons)

Item	Actual		Planned and estimated		
	1965	1969	1970	1975	1980
Iron ore:					
Domestic output	153.4	185.2	193.0	235.0	280.0
Imports	(1)	(1)	(1)	(1)	(1)
Exports	24.1	33.1	34.0	41.0	48.0
Apparent consumption	129.3	152.1	159.0	194.0	232.0
Pig iron:					
Domestic output	66.2	81.6	85.0	104.0	125.0
Imports	.1	.1	.1	.1	.1
Exports	3.7	4.7	5.0	6.5	8.0
Apparent consumption	62.6	77.0	80.1	97.6	117.1
Steel, domestic output	91.0	110.0	115.0	138.0	160.0
Rolled metal:					
Domestic output	70.9	87.5	91.0	112.0	132.0
Imports	.8	1.6	1.6	1.7	1.8
Exports	4.5	6.5	6.5	7.5	8.5
Apparent consumption	67.2	82.6	86.1	106.2	125.3
Steel pipe:					
Domestic output	9.0	11.5	12.3	15.5	18.0
Imports	.8	1.0	1.2	1.5	1.5
Exports	.3	.3	.3	.3	.4
Apparent consumption	9.5	12.2	13.2	16.7	19.1
Ferroalloys:					
Imports	.006	.007	.008	.010	.011
Exports	.205	.327	.350	.450	.550

[1] Insignificant.

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percent of the zinc was smelted with oxygen-enriched air blasts.

The planned increase in zinc output for 1970 was based on increased capacities at the Leninogorsk zinc plant and the Ust'-Kamenogorsk lead and zinc combine. However, except for certain secondary sections at the Leninogorsk plant, construction of these plants was far from completion. A complicating factor at many smelters was that lead concentrates contain as much as 3 percent copper and 12 percent zinc. The Ust'-Kamenogorsk lead plant experienced raw material shortages in 1969, and the quality of the concentrates supplied by the Zyryanovsk concentrating plant was not always satisfactory.

The Achisay combine in Kazakhstan, with its three main groups of mines, produced about 65,000 tons of lead, an unspecified quantity of silver, and an unknown quantity of barite. The Achisay ore contains from 1.5 to 2.0 percent lead, 13 to 15 percent barite, and 0.5 ounce silver per ton.

In other mine and plant developments, the Fiagdon lead-zinc concentrator in North Osetia was completed in January. It will supply raw material to the Elektrotsink plant in Ozdzhonikidze. A new section of the Leninogorsk No. 2 concentrator was commissioned in March. At Zyryanovsk, where heavy media separation was applied on an industrial scale for the first time in the U.S.S.R. in 1967, the second section of the heavy media plant was placed in operation. A production line for zinc concentrates was commissioned at the Gay mining and concentrating combine in Orenburg Oblast'. At the Sikhali polymetallic combine in Maritime Kray, a new production section was completed at the concentrator in 1969, and a new 850-meter shaft will be commissioned at the Slepaya mine. At the Chimkent lead plant in Kazakhstan, renovation of the sintering shop was completed, and construction of a new smelting shop was begun.

One of the Soviet Union's largest zinc plants, at Almalyk in Uzbekistan, was slated to go on stream in 1970. The complex is to process 3 million tons of lead-zinc-barite ores per year. Production is to begin in 1970, reaching full capacity by 1972. In Krasnoyarsk Kray, construction began on the new town of Novoangarsk at the confluence of the Angara and Yenisey rivers, where lead and zinc deposits were discovered. Elsewhere, five new polymetallic vein-type deposits were discovered in the Sikhote-Alin Mountains of Maritime Kray.

Magnesium.—Five magnesium plants with a combined annual capacity of over 50,000 tons produced an estimated 45,000 tons of magnesium in 1969. The magnesium plant of the Kalush chemico-metallurgical combine was commissioned in December. This is the first nonferrous metallurgical enterprise in Subcarpathia, Western Ukraine. Magnesium production at the Ust'-Kamenogorsk combine increased 6 percent over that in 1968.

Manganese.—The Soviet manganese industry remained the largest in the world. In 1969, estimated output of marketable manganese ore was 7 million tons, compared with 6.6 million in 1968. Estimated production levels for 1975 and 1980 are 9 million tons and 11 million tons, respectively. Mine-run ore production in 1969 was around 17 million tons, of which 70 percent came from the Nikopol' and Bol'she-Tokakskiy deposits. The second largest production was from the Chiatura basin in Georgia, and Kazakhstan was third. Exports of manganese ore increased from 1,150,000 tons in 1968 to 1,197,000 tons in 1969.

At yearend 1969, reserves of manganese ore categories A, B, and C1 (proved, probable, and part of possible) were estimated at 2,500 million tons, with an average manganese content of 23 to 26.4 percent. This included 1,020 million tons in the Nikopol' basin. Reserves of high-grade ore are located in the Chiatura basin.

There were 18 underground mines, 10 open pits, and eight concentration plants in operation in the Nikopol' basin in 1969, where the ore averages 26.4 percent manganese. Concentration by gravity and agglomeration yielded a recovery of 71 to 75 percent. Of total concentrate production, 45 to 48 percent had a manganese content of over 45 percent, with the balance containing around 34 percent Mn. Tailings contained 12 to 15 percent manganese. More than 70 percent of ore mined in the Nikopol' basin was obtained by open pit methods.

For the first time in the U.S.S.R., a belt conveyor was installed on the No. 7, inclined mine of the Nikopol' basin in 1969. The Bogdanovskiy North open pit, with a planned crude ore output of 1.1 million

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tons per year, was under development in this basin. The plan for development of the Hrushevskiy No. 2 mine was approved in 1969. The first stage of this mine is to include four shafts and an open pit with an annual production capacity about 3 million tons of crude ore.

There were 17 mines and eight concentrators in the Chiatura manganese basin at the beginning of 1969, and two more (with a total annual capacity of 130,000 tons) were commissioned at yearend. Ore grade at this basin averaged 23 percent, and recovery of manganese was about 75 percent in 1969. Of total beneficiated Chiatura output, 66 percent contained 48.7 percent manganese, and 34 percent contained 25.6 percent manganese. Approximately 80 percent of the ore was extracted by underground methods. New production facilities, with a total annual capacity of over 300,000 tons of crude ore, were under development at the Dargveti, Itkhvisi, and Rgani mines, and the second stage of the central flotation plant was under construction.

A new manganese deposit was discovered in the Atasu region of Kazakhstan in 1969. Reserves were said to be large.

Mercury.—Output of mercury was estimated at 47,000 flasks (76-pound), and the U.S.S.R. was apparently self-sufficient in mercury in 1969. During the 1966–70 period mercury output is to be increased by renovating and enlarging the Nikitovskiy mercury combine in the Ukraine and Khadarkan combine in Kirgiz S.S.R. Mercury output in 1970 is to be 1.5 times the 1965 level.

The first mercury was extracted at the Shorbulakh cinnabar deposit in the mountains of the Malyy Kavkaz Ridge, Azerbaydzhan, in November. Three other cinnabar deposits exist in the area and construction of a secondary mercury complex is to be started in 1970. Another deposit of mercury was discovered at the Kirgiz-Uzbek border in Central Asia.

Molybdenum.—Output of molybdenum concentrate (metal content) was estimated at 7,500 tons in 1969. About 50 percent of the production was from molybdenum ore, and the remainder from tungsten-molybdenum ores.

Armenia occupied first place in the production of molybdenum concentrate. The ore was shipped out of the republic for further processing.

The Sorskiy molybdenum combine in Krasnoyarsk Kray, the Dzhidinsk tungsten and molybdenum combine in Buryat A.S.S.R., and the molybdenum concentrator of the Balkhash metallurgical complex in Kazakhstan all increased output of molybdenum concentrate in 1969. The Tyrny-Auz tungsten-molybdenum combine in Kabardin A.S.S.R. was being enlarged. A total expansion of 50 percent was planned.

Nickel.—Next to Canada, the U.S.S.R. was the world's largest nickel producer in 1969, with an estimated 105,000 tons of smelter product. The regional centers of production, in order of importance, continued to be Norilsk, the Southern Urals, and the Kola Peninsula. Six smelters were in operation in 1969; at Norilsk; at Rezh, Ufaley, and Khalilovo in the Urals; and the Monchegorsk and Pechenga in the Kola Peninsula.

Proved, probable, and possible reserves of ore in the Soviet Union are estimated to contain more than 5 million tons of nickel. About half of the reserves consist of low-grade silicate ores and the remainder consists of nickel-copper sulfide ores containing commercially recoverable copper, cobalt, and platinum-group metals.

Developments in the nickel industry exceeded Soviet plans in 1969. Gipronikel (State Institute for Planning of Nickel Industry Establishments) completed plans for installing new equipment and increasing production of nickel and associated metals at Norilsk. In expansion of the industry during 1970–80, the first objective will be to increase smelter capacities, and the second will be to improve the nickel recovery in ore concentration processes. In the future, the U.S.S.R. expects to offer more nickel for export to non-Communist countries.

At the Talnakh deposits in Norilsk area, the Mayak mine was approaching planned capacity. The Komosomol'skiy mine, with a planned output of six times the Mayak capacity, was under development; the first stage was to go into operation in 1970. Development of a third mine (Oktyabrskiy) began in June; the first stage is scheduled for completion in 1974. The fourth and fifth mines (Skalistyy and Glubokiy), were being planned.

In the Kola Peninsula, nickel production at the Severonikel combine was modernized by the installation of large-capacity electric furnaces. Renovation of this combine im-

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proved the quality of nickel and cobalt. At Pechenga nickel, construction of the new crushing plant was nearing completion. The port of Murmansk began handling Morilsk ore for the Severonikel and Pechenganikel combines. During the artic navigation season 100,000 tons were received, and in 1970 this figure is to be doubled. Owing to irregular supplies, Severonickel output in the first half of 1969 was lower than in the corresponding period of 1968.

Platinum.—The U.S.S.R. remained the world's largest platinum-group-metals producer. A few enterprises produced platinum from placer mines in the Urals and Siberia, but virtually all primary metal was obtained as byproduct of copper and nickel refining at the Norilsk, Severonikel, and Pechenganikel combines. About three-quarters of the platinum-group metals came from Norilsk.

Reserves are adequate to maintain production for many years following the discovery of extensive new deposits of platinum-bearing copper-nickel ores in the Norilsk area in 1966–69.

The U.S.S.R. was steadily expanding its output of platinum-group metals. Output in 1970 was expected to be 60 percent greater than in 1965. In 1969, construction was in progress at the Talnakh mining combine in Norilsk and at the second sections of the Zhdanovskiy concentrator of the Severonickel combine in Monchegorsk (Kola Peninsula). Primary platinum-group-metals production in the Soviet Union is forecast to increase at an annual rate of 3 to 5 percent. The U.S.S.R. was expected to retain its position as the leading world producer, and the quantity available to non-Communist countries was expected to grow.

Exports of platinum-group metals from the Soviet Union are not published, but imports from the Soviet Union, as published by several countries, were as follows, in troy ounces:

	1966	1967	1968
United Kingdom	52,777	52,437	27,528
France	20,364	15,462	63,763
West Germany	291,736	196,859	205,057
Netherlands	11,478	6,237	15,882
United States	389,482	129,915	429,730
Japan	382,003	417,311	638,953
Total	1,147,840	818,221	1,380,913

Source: Statistical Summary of the Mineral Industry. World Production, Exports, and Imports. 1966–68, London, 1969, p. 308.

Rare Metals.—The Ust'-Kamenogorsk lead and zinc complex fulfilled its annual quota for tellurium, producing 12 percent more than in 1968. The Balkhash mining and metallurgical complex increased production of rhenium, and the Verkhnedneprovskiy combine in Ukraine increased production of zirconium concentrate. The Orlov mining and concentrating combine in Chita Oblast' was under construction. A pilot plant for the chemical extraction of tantalum was commissioned at this combine.

At lead and zinc plants only 40 percent of the total lead tailings were processed to extract rare and precious metals, and there was no processing of copper tailings.[25]

Silver.—Virtually all of the Soviet's silver was produced from lead, zinc, and copper ores. Production in 1969 was mainly centered in the Urals, Kazakhstan, East Siberia, the Soviet Far East, and Armenia.

Production of silver in lead and zinc concentrates at most mines apparently increased in 1969. The Sikhali ore mining and concentrating combine in Maritime Kray was one of the largest producers. The five mines of the Achisay lead-barite center in Kazakhstan sent 15,000 to 20,000 tons of ore per day to the Kentau concentrator in 1969. One ton of concentrate, produced by this plant contained 500 grams of silver.

Tin.—Although the Soviet tin production policy was based on self-sufficiency at any price, output of this metal continued to be inadequate to meet internal demand. About 20 percent of the requirements had to be imported in 1969. Imports of primary metal declined by 4 percent; production increased by an estimated 3.8 percent, and estimated consumption of primary and secondary metal advanced 6 percent. About 24 percent of the tin consumed in the U.S.S.R. in 1969 was recovered from secondary sources. In 1970, it is planned to increase production to 1.6 times the 1965 level.

The U.S.S.R. signed a $9.6 million contract with Head Wrightson Ltd. of the United Kingdom for the design, supply, and supervision of construction of an electrolytic tinplate plant, which is to be installed at Magnitogorsk.

The Soviet Far East, Yakutia, and

[25] Narodnoye Khozyaystvo Kazakhstana (The National Economy of Kazakhstan). Alma-Ata, No. 4, April 1969, pp. 24–29.

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Transbaykal were the main tin producing regions. In 1969, about 30 percent of total tin output came from placer deposits, which accounted for three-quarters of output from the Soviet Northeast. Maritime Kray produced the greatest amount of tin.

In Maritime Kray, expansion of the Khrustal'nyy mining and concentrating combine was continued. A new mine (the fourth) was under development in 1969, and two concentration plants were planned. In the same district, production capacity of the Taezhnyy concentrator was increased in February; this will increase the mine's output by almost one-third.

In Khabarovsk Kray, the first section of the concentrator at the Solnechnyy mining and concentration combine near Konsomol'sk/Amur was put into operation in June. A second section was under construction, and it is scheduled for completion in 1975. Out-dated equipment was reportedly installed.[26]

In other developments, construction of the Deputatskiy tin mining and concentrating combine in Yakut A.S.S.R. was scheduled to begin in 1970; completion was planned by 1975.

Prospecting and exploration for tin deposits, including study of abandoned workings, continued throughout 1969.

During 1969 Bolivian and Soviet experts considered Soviet cooperation in the Bolivian tin industry.

Titanium.—The Soviet titanium industry has been the second largest in the world since 1958, after that of the United States. The U.S.S.R. started selling large amounts of titanium to the United States and other countries. Soviet reserves of TiO_2 have been estimated at about 10 million tons, contained in 70 million tons of ore averaging 10 to 20 percent TiO_2. During 1966–70 a 140-percent increase in output is planned.

Development of the industry continued in the Ukraine, the center of titanium production. Major producers were the Samotkansk zirconium-titanium alluvial deposits and the Volchansk titanium deposit in Dnepropetrovsk Oblast'; the Irshansk, Streminogorsk, and Zelenogorsk titanium deposits in Zhitomir Oblast'; and the Tarasov titanium deposit in Kievsk Oblast'.

Two mining and concentrating combines —Verskhnedneprovsk and Irshansk—operated these deposits in 1969. Renovation of Verskhnedneprovsk No. 1 concentrator was completed in January. The No. 3 concentrator at Irshansk, and a plant for the production of titanium dioxide in the Crimea were under construction in 1969. The capacity of the Dneprovskiy titanium-magnesium plant, a leading nonferrous metal enterprise of the U.S.S.R., was steadily growing and the quality of products was improving. In 1969, titanium production at the Ust'-Kamenogorsk combine increased about 18 percent over that in 1968.

Tungsten.—Estimated production of tungsten in concentrates increased by 5 percent in 1969. Soviet tungsten industry development was concentrated in the North Caucasus, Transbaykal, the Soviet Far East, Central Asia, and Kazakhstan. More than 80 percent of the tungsten produced in the country was allocated to the ferrous metals industry. Up to 18 percent of the tungsten was used in ferroalloys; 2 to 5 percent was used in the electric industry. The Soviet official 1969 wholesale price of tungsten concentrates (60 percent WO_3) was 2,830 rubles per ton. Explored reserves of minable tungsten ores may be as large as 500,000 tons of 60 percent WO_3.

Tyrny-Auz, in the North Caucasus, is a group of contact-metasomatic tungsten molybdenum deposits in skarn, and is probably the largest of this type in the U.S.S.R. The average ore made is 1.3 percent WO_3. Output totaled about 4,500 tons of 60-percent WO_3 concentrate in 1969. The sixth section of the Tyrny-Auz concentrator was under construction in 1969; the Vostochnyy open pit was also under development. The Nal'Chik hydrometallurgical plant in the North Caucasus, which is based on the tungsten-molybdenum ores from Tyrny-Auz, continued operations in 1969 but without the expected increase in tungsten output.

The Dzhidinskiy tungsten and molybdenum combine in Buryat A.R.R.S. increased output of tungsten concentrate in 1969 by about 2 percent, compared with 1968. The combine installed new equipment in its ore concentrator plant. In the north of Maritime Kray, construction continued on the Primorsk tungsten combine at the Vostok–2 deposits. It is planned to start operations in 1971–72.

Vanadium.—The Soviet Union, with large vanadium resources, is becoming an important producer of this metal. The

[26] Sotsialisticheskaya industria (Socialist Industry). Moscow, July 12, 1969, p. 3.

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principal sources of vanadium in 1969 continued to be slag from smelting of titaniferrous magnetite from the Kachkanar mine in the Urals and iron ore from Lisakovska (0.06 percent V) in Kazakhstan. However, the metallurgical problems of vanadium recovery have not yet been satisfactorily resolved, and rated vanadium recovery has not been achieved.

A new plant for production of ferrovanadium from Urals magnetite ore was reportedly under construction at the Serov steel plant in the Urals. Elsewhere, the Pavlodar aluminum plant's experimental shop and the Kazakh Institute of Concentration and Metallurgy completed testing a method for obtaining V_2O_5 from aluminate solutions of Turgay bauxites.

NONMETALS

Asbestos.—Total production of six grades of asbestos in 1969 was estimated at 960,000 tons, 17 percent more than in 1968. Asbestos exports rose from 303,600 tons in 1968 to 346,500 tons in 1969. Canadian equipment is being used in a large-scale expansion of the industry.

Asbestos industry development was concentrated in the Urals, Kazakhstan, and the Tuva A.S.S.R. Total output of six grades of chrysotile asbestos at the Uralasbest combine was estimated at 740,000 tons. The No. 6 mill at this combine, with an annual capacity of 12 million tons of low-grade crude ore (1.7 percent) and 320,000 tons of asbestos concentrate, began operation in August. In Kazakhstan, the first section of the Dzhetygara asbestos combine produced about 235,000 tons in 1969; a second section was scheduled to be commissioned in 1970. The first stage of the Tuvaasbest combine at Ak-Dovurak in Tuva A.S.S.R. produced an estimated 25,000 tons in 1969; the second section of this combine was scheduled to go into operation in 1970.

Construction of the Kiembay asbestos combine in the Southern Urals was continued in 1969. In Buryat A.S.S.R. detailed exploration of the Molodezhnoye and Il'chirsk chrysotile asbestos deposits was completed. It is planned to develop these deposits in the future.

For some time anthophyllite and other nonchrysotile varieties of asbestos have been mined at the Sysertsk and Alapayevsk deposits in the Urals.

Barite.—About two-thirds of the Soviet barite consumption in 1969 was produced domestically, the balance being satisfied by imports. The main centers of barite output continued to be Georgia and West Siberia. Some small deposits were developed in the Urals, Kazakhstan, Azerbaydzhan, Armenia, and other regions. Over 30 percent of Soviet barite reserves are located in Georgia, but this republic produced over 70 percent of the total 1969 putput.

The increased output in 1969 was attributed largely to the completion of new plants. Several enterprises producing nonferrous metals also produced barite as a byproduct. In Kazakhstan, a barite section at the Kentau concentrating mill of the Achisay combine was expected to be completed in 1970. Equipped with machinery built in Czechoslovakia, the mill will be the largest barite concentrator in the U.S.S.R. Expansion of the Tekely combine in Maritime Kray was also underway. The new concentrating mill is to have several times the capacity of the present one.

The Apsherinskoye barite deposit discovered near Gudauta in Georgia, which is the largest in the Soviet Union, has reserves of 6 million tons of barite. A concentration mill is to be built at this deposit. The Began'skoye deposit in Transcarpathian Oblast' in the Ukraine contains about 3 million tons of barite.

Cement.—The Soviet Union, which has led the world in cement output during the last few years, has now taken first place in world cement exports. Approximately 110 plants, supplied with raw materials from 132 mines, accounted for the Soviet output-89.8 million tons in 1969, or 2.6 percent more than in 1968. The 1970 national quota is 91 million tons. Cement exports increased 12 percent in 1969 to about 3 million tons.

The first rotary kiln of the Staryy Oskol cement plant in Kursk Oblast', with an annual capacity of 600,000 tons, was put into operation in 1969. About 1.3 million tons of new cement capacity was added at the Ust'-Kamenogorsk, Alekeyevsk, and other cement plants.

Clays.—Armenia, Tadzhikistan, and Kazakhstan remained the three principal centers of bentonite production in the U.S.S.R. In 1969, almost 180,000 tons of bentonite was produced in Armenia, which is to become one of the largest suppliers of bentonite in the Soviet Union. Construction of the Idzhevanskiy bentonite combine

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in Armenia continued in 1969, with the first production stage to become operational in 1971. The full annual capacity of the project is to be 1.1 million tons. The Isfara plant in Tadzhikistan was being modernized.

Diamond.—The U.S.S.R. continued to make rapid progress in expanding its diamond industry, which is centered in Yakut A.S.S.R., where about 20 diamond deposits have been discovered. These deposits, however, cannot be fully exploited until the Vilyuy hydroelectric station is completed, probably in 1970. Production, estimated very roughly at 6 million carats of industrial diamonds and 1.5 million carats of gems in 1969, centers on the Mirnyy, Aykhal, Udachnaya, and Irelyakh deposits. Seven concentrators were in operation in 1969. Some of which were under renovation. Construction of the new Aykhal city started in 1968. It is planned to complete construction of concentrating plant No. 11 at Udachnaya open pit and the second section of concentrator No. 8 at the Aykhal open pit by the end of 1970. A small quantity of diamond was produced in the Vishera River region in Perm Oblast' (western Urals).

A second diamond-processing works was under construction in Kiev.

A substantial but unknown quantity of synthetic diamond was also produced in 1969 by plants in Kiev, Yerevan, and Moscow.

Fertilizer Materials.—In 1969 the U.S.S.R. produced about 10.8 million tons in 100-percent nutrient content, and 46 million tons in bulk fertilizer content.[27] Compared with 1968, Soviet mineral fertilizer output in 1969 increased over 2.5 million tons, 5.8 percent. This increase was attained largely through the commissioning of new capacities, but production targets for mineral fertilizers, ammonia, and sulfuric acid were not fulfilled.

There was a significant increase in exports of mineral fertilizers from the U.S.S.R. in 1969. Exports of apatite concentrate totaled 5.6 million tons, 10 percent more than in 1968. Exports of nitrogen fertilizers decreased from 947,000 tons in 1968 to 938,400 tons in 1969, exports of potassic salts (41.6 percent K_2O equivalent) totaled 1.72 million tons in 1968 and 1.68 million tons in 1969. Shipments of superphosphate declined slightly, from 445,600 tons in 1968 to 443,100 tons. However, despite the substantial production and large exports, fertilizers were in short supply, and the quantity of mineral fertilizers produced did not meet domestic consumer demands. Soviet fertilizers had a comparatively low total nutrient content, only around 25 percent.

The value of fixed assets of the Soviet mineral fertilizer industry exceeded 5 billion rubles. New facilities with an annual capacity of 11 million tons of mineral fertilizers, or about 85 percent of planned goals were commissioned in 1968. The first section of the complex fertilizer plant at Nevinomyssk in Stavropol Kray, constructed by Didierwerke A.G. of Essen, West Germany, was put into operation in December. The second section of the plant is to be completed in 1970. Total planned annual capacity of this plant is 460,000 tons.

Of 26 important fertilizer projects, only five met construction schedules in 1969.[28] More than a third of the most important construction projects of this industry were not put into operation within the planned time.[29] The main reason for the delay in work at many sites was the poor organization of labor, and the poorly timed and incomplete supply of material.[30] The 1970 plan envisages commissioning of new capacities for the production of 11.3 million tons of mineral fertilizers. It is planned to produce in 1970 57.5 million tons of mineral fertilizers, 25 percent more than in 1969. Expansion of the output is planned as follows: Nitrogen fertilizers by 28.7 percent; phosphates by 22 percent; and potassium by 45 percent. Estimated levels for 1975 and 1980 are 85 million, and 115 million tons, respectively. The 1971–75 plan envisages construction of new facilities with a total annual capacity of 40 million tons of mineral fertilizers, and a capital investment of about 7 billion rubles.

Soviet mineral fertilizers statistics are presented in table 6.

Phosphate.—Phosphate rock production totaled 42.5 million tons in 1969, including 25 million tons of apatite ore (17 to 18 percent P_2O_5) and 17.5 million tons of sed-

[27] The active ingredients (nitrogen, phosphorus, and potash) are expressed in terms of Soviet standard units which are not the same as used in the United States. Nitrogen is expressed as ammonium sulfate, 20.5 percent N, phosphate is expressed as 18.7 percent P_2O_5, potash is expressed as 41.6 percent K_2O, and ground rock phosphate (phosphatic flour) is expressed as 19 percent P_2O_5.

[28] Pravda. Moscow, Nov. 12, 1969, p. 2.

[29] Pravda. Moscow, Mar. 27, 1970, Editorial.

[30] Stroitel'naya gazeta (Construction Gazette). Moscow, Oct. 26, 1969, p. 1.

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imentary rock (13 percent P_2O_5). The main centers of crude phosphate rock output were the "Apatit" combine on the Kola Peninsula and phosphate deposits of Karatau in Kazakhstan, Kingisepp in Leningrad Oblast', and others. Apatite concentrate with 39.4 percent P_2O_5 provided about 75 percent of all raw materials for the production of phosphate fertilizers. New facilities for annual production of 1.8 million tons of apatite concentrate (ore-dressing plant N2) and 0.7 million tons of apatite ore (Yukspor mine) were put into operation at "Apatit" combine on December 31.

Potassium.—The U.S.S.R is one of the largest potash producing and consuming countries in the world. Estimated 1969 potash output was 3.18 million tons K_2O equivalent, about 2 percent over 1968 levels. Expansion of potash production facilities in the Soviet Union is expected to continue, and the U.S.S.R. will be in an increasingly strong position to compete in world markets.

There are four major potash producing centers in the U.S.S.R.: Solikamsk and Berezniki on the west side of the central Urals, Soligorsk in Belorussia, and Stebnikov and Kalush in the Western Ukraine. The following six combines were in operation in 1969; Solikamsk, Berezniki No. 1, Soligorsk Nos. 1 and 2, the first stages of Novo-Stebnikov, and Kalush combines. The first stages of the Berezniki No. 2 potassium combine, with an annual capacity of 1.7 million tons, and Soligorsk No. 3, with a capacity of 1.2 million tons, were put into operation in December. The second stage of Novo-Stebnikov, Soligorsk No. 3, and Berezniki No. 2 were scheduled to begin operations in 1970. It is planned to construct four more combines in 1971–75.

At the Dombrovskiy pit of the Kalush combine, potassium salt was mined by surface methods for the first time in the world.

Nitrogen.—Of total fertilizer production, nitrogen-based materials have made the most significant progress-output expanded from 3.7 million tons N in 1967 to an estimated 4.4 million tons N in 1969. The bulk of Nitrogen production in the U.S.S.R. is in the form of ammonium nitrate fertilizers, although the production of urea and other products has increased in recent years. Ammonium sulfate comprise only 6 to 7 percent of the total nitrogen fertilizer production in 1969.

Two ammonia plants were delivered by Czechoslovakia to the U.S.S.R. for erection at Novogorod and Cherepovets. The M.W. Kellog Co., New York, and the Tayo Engineering Corporation of Japan received an order from the Soviet Union for a 450,000-ton-per-year ammonia plant.

Fluorspar.—Fluorspar output remained well below domestic demand, despite considerable reserves. Imports of fluorspar increased from 102,000 tons in 1968 to 134,100 tons in 1969. Consumption of fluorspar in 1969 was estimated at 534,000 tons; the iron and steel industry accounted for

Table 6.—U.S.S.R.: Salient mineral fertilizers statistics
(Million metric tons)

Item	Actual		Planned and estimated			
	1960	1965	1969	1970	1975	1980
Fertilizer output:						
100-percent nutrient content:						
Nitrogenous	1.0	2.7	4.4	5.3	7.8	10.0
Phosphatic	.9	1.6	2.1	2.6	3.8	6.0
Potassic	1.1	2.4	3.2	4.5	6.8	9.0
Phosphatic flour	.8	.7	1.1	1.2	1.6	2.0
Total	3.8	7.4	10.8	13.6	20.0	27.0
Bulk fertilizer content:						
Nitrogenous	4.9	18.2	21.6	26.0	33.0	41.0
Phosphatic	4.9	8.6	11.0	14.0	26.0	39.0
Potassic	2.6	5.7	7.8	10.7	14.0	17.0
Phosphatic meal	1.5	3.7	5.6	7.3	12.0	18.0
Total	13.9	31.2	46.0	58.0	85.0	115.0
Exports:						
Apatite ore, 17.7 percent P_2O_5	.1	.1	.1	.1	.1	.1
Apatite concentrates, 39.4 percent P_2O_5	1.8	3.5	5.6	5.9	7.8	11.5
Superphosphate, not less than 18.7 percent P_2O_5	.2	.2	.4	.4	.6	.9
Ammonium nitrate	.1	(1)	.2	.2	.3	.5
Ammonium sulfate	.2	.3	.7	.8	1.2	1.5
Potassium salts, KCl, 41.6 percent K_2O equivalent	.6	.8	1.7	2.0	3.0	4.0

[1] Insignificant.

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more than three-quarters of the total. The Maritime Kray, Chita Oblast' Buryat A.S.S.R., and Central Asia were the main production areas in 1969.

A fluorspar concentrating mill with an annual production capacity of 20,000 tons began operating at the Kalanguev mines in Chita Oblast' in December. The first plant in the U.S.S.R. for production of fluorspar pellets, with a design capacity of 20,000 tons per year, was under construction in Transbaykal. A new fluorspar deposit was discovered in the Daur Steppes of Chita Oblast' in 1969.

Graphite.—Increased domestic output of natural graphite in 1969 was supplemented by material recovered from metallurgical wastes of iron and steel plants. The Soviet Union's first plant for production of fettled graphite (a raw material for artificial diamond) was commissioned at the Zavalovskiy combine in Kirovgrad Oblast' (Ukraine) in September. This combine exceeded its 1969 production quota.

Mica.—The domestic supply of mica was augmented by large imports, and mica requirements were reduced by increasing use of substitutes. Imports of high-grade mica rose from 160 tons in 1968 to 417 tons in 1969.

Irkutsk Oblast' was the main Soviet supplier of mica, with 75 percent of all mica deposits in the country located in Mamsko Chuyskiy County. Nine mines were operating in this area; the Irkutsk mica factory was the largest in the U.S.S.R. Mica was also mined in Yakut A.S.S.R., Karelo-Murmanskiy region, and elsewhere.

Sulfur.—The U.S.S.R. has large reserves of sulfur, but the grade of ore is low and production costs are high. Estimated domestic production of contained sulfur totaled 3.45 million tons, of which 1.85 million tons was recovered from pyrite, 1.12 million tons from native sulfur, and 0.48 million tons from other elemental sulfur. Consumption of sulfur from all sources totaled 2.3 million tons; about 1.5 percent more than in 1968. Exports of sulfur and pyrite in 1969 totaled 362,500 tons and 1,533,000 tons, respectively. Exports of sulfur from the U.S.S.R. increased by 24 percent during 1969 from the level for 1968 and continued to be primarily oriented to Communist countries. Shipments of pyrite in 1969 were the same as in the previous year. A 17-percent decrease was registered in exports of sulfuric acid.

In 1969, the principal producing centers of native sulfur were Rozdol and Yavorov (West Ukraine); Gaurdak, Shorsu, and Changyrtash (Central Asia); and the Kuybyshev sulfur combine. The Rozdol combine was the country's major producer of native sulfur, and with the Gaurdak combine provided the bulk of the country's sulfur requirements. The Rozdol combine increased output of sulfur ore by 20 percent in 1969, and Gaurdak production was increased by 33 percent. About 85 percent of the sulfur ore at Gaurdok was being mined. opencast. The Kuybyshev sulfur combine accounted for only 10 to 12 percent of the Soviet output of Native sulfur in 1969.

Production of sulfuric acid was begun at several nonferrous metal smelters in 1969. In Orenburg Oblast', the original Mednogorsk plant for producing sulfuric acid from smelter gas was largely replaced, owing to unexpectedly heavy corrosion.

In other developments, the Karobogaz combine in Turkmen S.S.R. started extracting sulfur from mirabilite obtained from the Caspian Sea. At the Yavorov combine, the country's first pilot installation using the Frasch process began operation. Deposits of sulfur were discovered on the Kamchatka peninsula and Sakhalin. The U.S.S.R. signed a contract with Poland for the purchase of three sulfuric acid plants, each with an annual capacity of 563,000 tons.

Talc.—The U.S.S.R. produced an estimated 380,000 tons of talc in 1969, 2.7 percent more than in 1968. Despite large reserves and the development of new mines and beneficiation facilities, imports of talc increased from 50,800 tons in 1968 to 82,700 tons in 1969. In 1969, only the Onotsk deposit in Irkutsk Oblast', with an annual production capacity of 45,000 tons, produced high-grade talc. The raw material was shipped to the Miass talc mill in the Urals.

The Kirgiteysk deposit in Krasnoyarsk Kray was the major producer of lower-quality talc. The Miass and Shabrovsk deposits in the Urals ranked second in tonnage talc output.

MINERAL FUELS

Planned changes in the fuel production structure and the eastward shift of fuels production continued in 1969. Although the trend is toward increasing production

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of crude oil and natural gas coal was still the major source of energy consumed in the Soviet Union and will remain so for a number of years.

In 1969, gains of 6 percent in petroleum and natural gas output, and 2.3 percent in coal output were registered over 1968 production. In spite of fuel industry expansion in recent years, output has not kept up with the demands of the Soviet economy, particularly in the European part of the U.S.S.R. According to Soviet sources, the fuel deficit in the European part of the country reached tens of millions of tons of standard fuel equivalent in 1969, and will grow to 80 to 100 million tons by 1970, and to 140 to 150 million tons of standard fuel by 1975. Moreover, fuel exports have intensified this problem. This deficit cannot be avoided because of continuous growth in energy consumption in this area concomitant with industrial development, growing fuel exports, and insufficient production of coal in the Donets basin. The production of coal, gas, oil shale, and peat were below both industry requirements and 5-year plan targets. New goals were planned for 1969 through 1970.

The fuel industry of the R.S.F.S.R. showed a growth rate of 5 percent in 1969. About 266 million tons of petroleum, 82.1 billion cubic meters of gas, and 335 million tons of run-of-mine coal and lignite (including 63.3 million tons of coking coal) were produced in the Republic in 1969. Petroleum production in the R.S.F.S.R. in 1969 rose by 14 million tons over 1968 output, whereas the output of run-of-mine coal and lignite was 5 million tons greater, and the output of gas 2.6 billion cubic meters was more than in 1968. The Ukraine accounted for 29.8 percent of the total extraction of natural gas, 33.4 percent of run-of-mine coal and lignite (including more than one-half for coking), and more than 51 percent of the nation's output of coke.

Total production of primary energy from mineral fuels, fuelwood, hydroelectric, and nuclear sources rose from 699.1 million tons of standard fuel equivalent in 1960 to an estimated 1,193.4 million tons in 1969. By 1980, Soviet total primary energy production is to rise to 1,796 million tons of standard fuel. Compared with 1969 output, gas is to rise by 104 percent, coal and lignite by 10 percent, oil by 64 percent, hydroelectric power by 186 percent, and nuclear power by 250 percent.

As shown in table 7, total consumption of all types of primary energy in the Soviet Union is to be equivalent to over 1,300 million tons of standard fuel in 1975 and about 1,550 million tons in 1980.

In 1969, the U.S.S.R. produced 689 billion kilowatt-hours of electricity (kwh), 8 percent more than in 1968. It is planned to produce 740 billion kwh in 1970. Installed capacity of electric stations of the country at yearend totaled 154.4 million kilowatts. In 1969, the Soviet Union exported 5.9 billion kwh of electricity. In 1971–75 the country is to export 1.5 billion kwh to Poland, 4.0 billion kwh to Hungary, and 3 billion kwh to Bulgaria. It will also supply small quantities of power to Finland and Norway.

Coal.—The Soviet Union produced 608 million tons of run-of-mine coal (or an estimated 348 million tons of clean coal) placing it second among world coal producers. The 10 major and numerous minor coalfields produced 468 million tons of run-of-mine hard coal (390 million tons of bituminous and 78 million tons of anthracite) and 140 million tons of lignite. Over 25 percent of the total output came from stripping operations. The 2.3-percent increase over the 1968 level was achieved mainly in coking coal, 161 million of which was produced, 4.2 percent more than in 1968.

In 1969, there were 981 underground coal mines (under the Ministry of Coal Industry) with an average annual capacity of 457,000 tons (from 200,000 to 1,800,000 tons) and 67 open pits with average annual output of about 2.2 million tons of run-of-mine coal in operation. The throughput of 170 preparation plants was 270 million tons of run-of-mine coal (164 million tons of clean coal), only 44.5 percent of the total coal output. The average ash content of all usable coal was 19.7 percent in 1969, however, home heating fuel ranged up to 45 percent. The calorific value of coal shipped averaged a little more than 5,000 kilocalories per kilogram.

The maximum depth at which underground coal production was carried out reached 1,100 meters in 1969; the average depth was about 345 meters. Average depth by basin were 410 meters in the Donets, 225 meters in Kuznetsk, over 300 meters in Karaganda, 57 meters in

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Table 7.—U.S.S.R.: Total primary energy balance

(Million tons of standard fuel equivalent) [1]

Year	Total primary energy	Coal (lignite, anthracite, and bituminous, and coke)	Crude oil and petroleum products	Natural and associated gas	Peat	Oil shale	Fuelwood	Hydro-electric power	Nuclear power
1960:									
Production	699.1	373.1	211.4	54.4	20.4	4.8	28.7	6.3	-----
Imports	12.3	5.6	6.7	-----	-----	-----	-----	-----	-----
Exports	65.6	16.0	49.3	.3	-----	-----	-----	-----	-----
Apparent consumption	645.8	362.7	168.8	54.1	20.4	4.8	28.7	6.3	-----
1965:									
Production	976.7	412.5	346.4	149.8	17.0	7.4	33.5	10.0	0.1
Imports	10.6	7.6	3.0	-----	-----	-----	-----	-----	-----
Exports	123.0	27.7	94.6	.5	-----	-----	-----	.2	-----
Apparent consumption	864.3	392.4	254.8	149.3	17.0	7.4	33.5	9.8	.1
1969: e									
Production	1,198.4	438.0	470.0	214.0	19.0	8.0	30.0	14.0	.4
Imports	10.0	8.0	[2]	2.0	-----	-----	-----	-----	-----
Exports	178.4	27.0	148.0	3.0	-----	-----	-----	.4	-----
Apparent consumption	1,030.0	419.0	327.0	213.0	19.0	8.0	30.0	13.6	.4
1975: e									
Production	1,515.0	461.0	636.0	330.0	20.0	10.0	30.0	27.0	1.0
Imports	31.0	9.0	7.0	15.0	-----	-----	-----	-----	-----
Exports	237.0	29.0	185.0	22.0	-----	-----	-----	1.0	-----
Apparent consumption	1,309.0	441.0	458.0	323.0	20.0	10.0	30.0	26.0	1.0
1980: r e									
Production	1,796.0	483.0	772.0	436.0	21.0	12.0	30.0	40.0	2.0
Imports	40.0	10.0	14.0	16.0	-----	-----	-----	-----	-----
Exports	292.0	30.0	223.0	87.0	-----	-----	-----	2.0	-----
Apparent consumption	1,544.0	463.0	563.0	415.0	21.0	12.0	30.0	38.0	2.0

e Estimate. r Revised.

[1] Metric ton of standard fuel equivalent has a calorific value of 7 million kilocalories (7,000 kilocalories per kilogram) or the equivalent of 27,780,000 British thermal units (18,100 Btu per pound).

[2] Negligible.

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Moscow, and about 400 meters in the Pechora. The average working thickness of the coal seams, according to 1969 data, was 1.32 meters. Figures by basin were as follows: 0.95 meter in the Donets, 2.23 meters in Kuznetsk, 2.27 meters in Moscow, 1.99 meters in Karaganda and 1.70 meters in the Pechora. The relative share of coal production from gently sloping seams was about 70 percent, that of inclined seams was 14 percent, and that from steep seams was 16 percent. The hand loading of coal at gently inclined seams was 21.19 percent in 1969.

Distribution of coal production by mining method was as follows: Longwall, 85 percent; slicing, 8 percent; shield, 3.2 percent; room and piller, 1.7 percent; and others, 2.1 percent. In 1969, the average longwall length was 115 meters and average advance 34.5 meters per month. The average capacity of each mining section (longwall) was 313 tons per day (4 shifts) in 1969. The number of legally prescribed working hours per week was 41 on the surface and 36 underground.

The coal industry employed about 2.9 million men and women, including 1.2 million "production workers." 61,500 university graduate engineers, and 141,000 graduate technicians. On the average there were 60 specialists (mainly mining engineers and geologists) with university degrees and 140 technicians to a mine. The coal industry had 36 research and design establishments with a total staff of over 41,000 persons. In 1969, the coal trusts, serving as intermediaries between the mines and the concerns ("Kombinats") were abolished.

In 1969, 44 percent of the coal mines and open pits did not meet production quotas, and 28.6 percent of the coal industry enterprises did not attain the planned capacities.[31] The average production cost of 1 ton of run-of-mine coal in 1968, was 12.69 rubles.

Production is slated to rise to 618 million tons of raw (354 million tons of clean) coal in 1970. It is estimated however, that production in 1970 probably will be approximately 615 million tons of raw coal, or 352 million tons of clean coal. Estimated levels for 1975 and 1980 are 640 million raw (366 million clean) and 670 million raw (383 million clean), coal, respectively.

Consumption.—Over 200 million tons of run-of-mine coal was used by thermal electric powerplants, about 165 million tons of raw coal was used by produce coke, 23.3 million tons of prepared coal for exports and the balance for industry and domestic heating. The consumption of coal instead of oil wherever possible was encouraged as a means of increasing the availability of oil for export.

Reserves.—In December 1969, coal resources were adjusted downward to 6,800 billion tons, from the previously reported 8,699.5 billion tons. The revision was made because the depth used for lignite calculations was changed from 1,800 meters to 600 meters.

New Capacities.—Of the 22 underground mines and open pits planned with a total annual capacity of over 20 million tons, 14 underground mines and open pits, with a total capacity of 13.3 million tons of run-of-mine coal, were put into operation in 1969. Capital investment for 1969 was 1,424 million rubles. The more important enterprises put into operation included the first stages of Azeyskiy (in Irkutsk Oblast') and Bogorodinskiy (in Moscow Oblast') open pits, and the Tentekskaya-Vertikal'naya No. 1-2 mine in the Karaganda Oblast'; and new coal preparation plants, the Berezovo-Biryulinskaya in the Kuznetskiy basin, the Sokolovsko-Ayutinskaya, and Komendantskaya in the Donets basin.

At many mines construction schedules were double the planned building period. The Mushketovskaya-Zepeval'naya No. 2 mine in the Donets basin required 13 years to build, and the Mariya-Glubakaya (now the Menzhinskiy) mine took longer. Mine No. 4-6 of the Pervomayskugol'Trust in Lugansk Oblast' has been under renovation for 10 years. The development of the Anzhersk No. 5-7 mine in the Kuznetsk basin has been underway since 1950. It has been calculated that when construction takes more than 10 years, the estimated cost doubles; when it takes longer than 15 years, the estimated cost triples. Problems also arose because mine project plans became out-dated, and had to be frequently revised.[32]

Nearly one-third of all Ukranian coal mines did not reach their planned capacity in 1969. Some of them have been lagging

[31] Ugol' (Coal). Moscow, March 1970, No. 3, p. 72.
[32] Ekonomicheskaya gazeta (Economic Gazette). Moscow, No. 24, 1969, p. 14.

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behind their annual targets for many years. Of 50 mines put into operation in the Donets, Kuznetsk, and Pechora coal basins in the past 10 years, 22 had not attained their capacities. There were many enterprises in the coal industry that failed to reach the planned indexes in 5 to 6 years.[33]

Production Centers.—Production of coal at major coal basins in 1969 was as follows, in percent:

Donets (558 underground mines)	35.8
Kuznetsk (94 underground mines and 14 open pits)	18.0
Karaganda (37 underground mines)	6.1
Moscow (86 underground lignite mines)	5.9
Pechora (18 underground mines)	3.5
Urals	7.4
East Siberia	8.1
Soviet Far East	4.8
Others	10.4
Total	100.0

The Donets, Kuznetsk, Karanganda, and Pechora coal basins produced over four-fifths of the total coal output in terms of calorific value and 97 percent of the coking coal in the Soviet Union.

Mechanization.—The expansion of the Soviet coal industry was largely due to growing inputs of labor and capital rather than to advancing technology. The introduction of a prop-free-front system and coal ploughs in longwall coal mining followed 12 years after its initiation in Britain and West Germany. The technical level of the Soviet coal industry was generally lower than that of the West European coal producing countries (1) mechanized loading, (2) the application of narrow-web coal face cutting and, (3) mechanized roof-support work.

Power supports were used in 549 (of total 4,356) longwalls in 1969. About 65 million tons of coal, or about 20 percent of the total output from working faces in slightly sloping seams (mainly in the Moscow lignite basin), were mined from such faces. Only about 200 longwall faces were equipped with walking hydraulic face supports. In many longwalls equipped with wide-web cutter-loaders and cutters, large amounts of coal were being extracted by blasting.

In many coal mines, the capacity of the hoists and the transport and surface complexes did not match the productivity of new longwall equipment, and thus resulted in the underutilization of the latter. In the Donets basin, half of the mines were small mines using older production methods with simple surface complexes, low-capacity hoists, and multistage transport.[34]

The productivity of narrow web combines was one-third to one-half of established norms. About 70 percent of mining machinery and equipment was under repair or inoperative. Machinery that would provide a large yield of anthracite of large and medium grades was unavailable. Nearly two-thirds of the anthracite produced was culm. The coal industry suffered large losses because of this problem.[35]

Productivity.—Manual labor was used almost exclusively in conveyor transfer, roof support, and surface operations. At a majority of the mines, the annual growth rate of the load factor at the longwall has thus remained low despite the continued increase in the installation of new mining equipment. Longwalls have been idled for long periods because of difficulties with equipment, a lack of empty cars, and delays in the delivery of materials.

In 1969 average monthly (25.4 shifts) official productivity of the Soviet coal miners was 56.1 tons, including 44.3 tons in underground mining and 272.7 tons in open pits. But these data are misleading because they are limited to a restricted group of "production workers". Furthermore, the productivity statistics on the Soviet coal industry are based on unprepared run-of-mine coal, whereas it is customary elsewhere to measure output and productivity in terms of marketable coal. If the above mentioned indexes are taken as reasonably accurate, they contain a more than twofold exaggeration of labor productivity over actual performance.

Hydraulic Mining.—In Soviet practice, hydraulic coal mining involves primarily hydraulic transport from the face to the mine surface. Actual cutting of coal is by a combination of conventional and hydraulic methods. Labor productivity was 50 percent below that planned, costs proved to be double, and operational losses of coal (up to 40 percent) were 2.3 times those planned. The Ministry of Coal Industry decided 3 years ago not to build any more hydraulic mines until some of the technical problems were solved.

Preparation.—Coal preparation in the

[33] Pravda. Moscow, Jan. 20, 1970, p. 2.
[34] Planovoye khozyaystvo (Planned Economy). Moscow, No. 6, June 1968, pp. 13–20.
[35] Pravda. Moscow, May 19, 1969, p. 2.

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U.S.S.R. has usually been restricted to coking coals and export coal because there is insufficient preparation capacity available to serve both foreign and domestic markets. As a result, the ash content of shipped coal rose to 19.7 percent in 1969. According to Soviet source, 61.4 percent of coal beneficiated was washed, 16.8 percent was treated by heavy media, 13 percent was prepared by pneumatic methods, 8.6 percent was treated by flotation, and 0.2 percent was treated by other methods.

Trade.—Exports of coal and coke totaled 27.3 million tons in 1969, a 8.8 percent increase compared with those in 1968. Of the 1969 total, approximately 11 million tons were exported to non-Communist countries; this was mostly high-quality coking coal and anthracite, mainly from the Donets basin. The Soviet policy of increasing exports of high-quality coal and coke to non-Communist countries will be continued in the future, but the exports of solid fuels to non-Communist countries is not likely to grow significantly. As in the past, the market for coal and coke from the U.S.S.R. will be limited mainly to East and West Europe and Japan.

Although coal and coke imports from Poland (7.9 million tons in 1969) were down 3.8 percent from those of the previous year, most was reexported to East Europe.

Soviet coal and coke statistics are presented in table 8.

Natural Gas.—The country produced 182.8 billion cubic meters of usable gas, about 7 percent more than in 1968, but below the 1969 plan target of 185.8 billion cubic meters. Of this qunatity 99 percent consisted of natural gas and oil associated gas, and one percent came from the gasification of oil shale and coal. In 1969, gas accounted for 18 percent of the Soviet fuel production. Over three-quarters of the total was produced in the European part of the U.S.S.R., including nearly one-third in the Ukraine. Although the production of natural gas in the Soviet Union during 1959–69, increased from 28.1 billion cubic meters in 1958 to 182.8 billion in 1969, the gas industry has not been able to meet any annual goal for production since 1956. During the past 3 to 4 years the rates of the growth in gas extraction, despite the discovery of large gasfields in West Siberia, the Komi A.S.S.R., Orenburg Oblast' and other regions, has somewhat declined, mainly because of shortages of pipe.[36]

In 1969 there were 570 gas, gas condensate, and gas-oilfields in the Soviet Union. Over 170 fields were in production, but the bulk of output was extracted from a relatively few large fields. Two-thirds of natural gas production came from six of

[36] Pravda. Moscow, May 23, 1969, p. 2.

Table 8.—U.S.S.R.: Salient coal and coke statistics

(Million metric tons)

Item	Actual	Planned and estimated			
	1965	1969	1970	1975	1980
Coal:					
Domestic output:					
Run-of-mine coal [1]	578.0	608.0	615.0	640.0	670.0
Clean coal [2]	331.0	348.0	352.0	366.0	383.0
Imports from other Communist countries [3]	6.7	7.2	7.8	8.0	9.0
Exports:					
To other Communist countries	15.3	13.5	14.5	15.0	16.0
To non-Communist countries	7.1	9.8	9.0	9.5	10.0
Total	22.4	23.3	23.5	24.5	26.0
Apparent consumption:					
Run-of-mine coal [1]	562.3	591.9	598.8	623.5	653.0
Clean coal [2]	315.3	331.9	335.8	349.5	366.0
Coke:					
Domestic output	67.5	78.5	76.0	86.0	96.0
Imports from other Communist countries [3]	.7	.7	.7	.8	.8
Exports:					
To other Communist countries	2.8	3.0	3.0	3.2	3.4
To non-Communist countries	1.0	1.0	1.1	1.0	1.0
Total	3.8	4.0	4.1	4.2	4.4
Apparent consumption	64.4	70.2	72.6	82.6	92.4

[1] Run-of-mine coal as reported in Soviet sources.
[2] Clean coal; estimated in accordance with Western standards.
[3] None from non-Communist countries.

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the largest fields, including those at Shebelinka in the Ukraine, Gazli in Uzbekistan, Stavropol' in the Northern Caucasus, and the Krasnodar fields. There were over 3,000 producing wells in 1969, about 10 percent of which were idle. About 13 percent of the gas enterprises did not fulfill their output quota. The capacity of truck pipelines and gas treatment plants were not sufficiently utilized. The quality of construction works at many projects remained low. As of January 1, 1970, the total length of gas trunk pipelines reached 62,400 kilometers. Capital investment in 1969 was 1.26 billion rubles. The plan for putting developmental gas wells and pipelines into operation was not fulfilled.

A contract for large gas deliveries from the Soviet Union to Italy was signed. West Germany was to join Italy in purchasing natural gas. Soviet gas was already going to Czechoslovakia, Poland, and Austria. Agreements were signed for the construction of gas pipelines to transport gas from the Soviet Union to Bulgaria and East Germany. Until 1980 the U.S.S.R. is to supply gas to East and West European countries from the Ukrainian fields. Gas deliveries from Afghanistan began in September 1967. A Soviet-Iran agreement envisages delivery of Iranian gas to the U.S.S.R. in 1970.

Natural gas production is slated to rise to 195.8 billion cubic meters in 1970; estimated levels for 1975 and 1980 are 280 billion and 370 billion, respectively. Capital investments for 1970 planned 1,656 billion rubles, or 31 percent over 1969 levels.

About 59 percent of all gas produced in the U.S.S.R. in 1969 was utilized for industrial purposes; over 28 percent was used as fuel in powerplants, and the remaining 13 percent was consumed by domestic users. Among the various branches of heavy industry, ferrous metallurgy was the largest consumer of gas.

Exploration and Reserves.—In 1969 several gas fields were discovered including Yubileynoye in Tymen Oblast' Ozernaya, in the Taymyr Peninsula, and Kazantsevo and Petlyanka in the Norilsk area. For the first time natural gas was found in Chukotka. At yearend 1969, natural gas reserves in categories A, B, and C1 reached 12,000 billion cubic meters, including an estimated 1,800 billion cubic meters of proved reserves (Soviet category A).

Five new gasfields were put into operation in the Ukraine, Krasnodar and Stavropol' Krays. Deep drilling plans were not fulfilled in 1969 in several regions of the Urals' Volga area and in Azerbaydzhan.

Gasfields.—The basic increments in gas extraction in 1969 was provided by the Ukraine (4.5 billion cubic meters), Turkmen S.S.R. (2.7 billions), R.S.F.S.R. (2.6 billions), and Uzbek S.S.R. (1.8 billion cubic meters).

The Ukraine, which produced 55.6 billion cubic meters of natural gas from more than 30 gasfields, continued to occupy first place in the production of gas in the U.S.S.R. Two new gasfields the Sotnivsk in Khar'kov Oblast' and the Borodchansk in Ivan-Frankovsk Oblast', were commissioned in 1969, as well as 55 new wells. Capital investment in the gas industry of the Ukraine was increased to 130 million rubles in 1969, as compared with 58 million in 1968. Natural gas production is slated to rise to 60 billion cubic meters in 1970. The Shebelinka gasfield is to provide 50 percent of the total Ukrainian gas output. The Efremovka and Krestishchena gas-condensate fields are particularly important for the future growth in gas extraction in the Ukraine.

Uzbekistan with an output of 30.4 billion cubic meters was the second largest gas-producing region. It is planned to produce 31.6 billion cubic meters in 1970. The gasfield at Gazli, the largest in this Republic, produced from more than 200 developmental wells over three-quarters of the Uzbekistan total. The Kuban' region, third in gas output, produced about 27 billion cubic meters of natural gas, followed by Tyuman' Oblast' (9 billlion cubic meters), Turkemenia (7 billion) Povolga area, Bashkir A.S.S.R., and Komi A.S.S.R. (about 2.5 billion cubic meters). Kazakhstan produced only 0.7 billion cubic meters. The extraction of natural gas began at the Ayritan field in northern Tadzhikistan. The 1970 plan calls for putting into operation about 500 developmental gas wells.

Transportation.—The total length of gas trunk pipeline was 62,400 kilometers at yearend; 3,378 kilometers of gas trunk pipelines were completed during the year, including the 1,200-millimeter-diameter, 1,080-kilometer Ukhta-Torzhok line; the 1,200-millimeter-diameter, 700-kilometer Central Asia-Center N2; the 1,020-millimeter, 500-kilometer section of the Yefremovka-Dikanka-Kiev-Western regions line; and

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the 720-millimeter, 250-kilometer Messoyakha-Norilsk arctic line; and the 820-millimeter, 447-kilometer Mokrous Kuybyshev-Tolyatti line. The 1970 plan calls for the construction of almost 4,500 kilometers of main gas pipelines and branches.

Further expansion of gas supplies is dependent to a great degree on the availability of large-diameter pipe and how fast pipelines can be laid.

Underground Gas Storage.—On January 1, 1970, the total volume of underground storage facilities was 8 billion cubic meters (4.25 billion cubic meters were under exploitation). Five underground gas depots (from a total of 12) were in operation. The second stage of the Peschano-Umetskiy underground gas storage near Saratov, with a capacity of 2 billion cubic meters, was commissioned in July.

Trade.—In 1969 the U.S.S.R. exported 2.7 billion cubic meters of natural gas to Austria, Poland, and Czechoslovakia by pipeline (with a planned annual capacity of 4 billion cubic meters) from the Dashava fields of the Western Ukraine. Construction of the 1,020-millimeter-diameter, 1,040-kilometer Yefremovka - Kiev - Western regions line, with an annual capacity of up to 10 billion cubic meters is to be completed by 1970.

A 20-year agreement to supply more than 100 billion meters of Soviet natural gas to Italy and for Italy to supply 1,420-millimeter pipe to the U.S.S.R. was signed in December. The delivery of Soviet gas is to start in 1973. The U.S.S.R. offered natural gas to Japan, West Germany, France, Finland, and other West European countries. Agreements were signed to deliver gas from the Soviet Union to Bulgaria and East Germany. In 1974–75 the U.S.S.R. is to start exports of gas to Hungary.

In 1970 Soviet gas exports will total over 3 billion cubic meters that will be equally distributed to Poland, Czechoslovakia, and Austria. By 1975, West Germany, Finland, and probably France and Japan will be added to the list.

Exports of gas from the U.S.S.R. to East European Communist countries might amount to as much as 10 billion cubic meters in 1975. Exports to non-Communist countries by 1975 possibly might fall short of 9 billion cubic meters. Total exports of gas from the Soviet Union might reach as much as 31 billion cubic meters in 1980, including 16 billion to the non-Communist countries and 15 billion to East European Communist countries.

Over 2 billion cubic meters of natural gas were imported from Afghanistan in 1969 via the pipeline from Shibarghan to Central Asia. The Iran-U.S.S.R. pipeline is scheduled to be completed in 1970 when it is proposed to deliver the first 3 billion cubic meters of gas. Information in the Soviet press indicates the desire of planners to import from Iran and Afghanistan about 5 billion cubic meters in 1970, 13 billion in 1975, and 14 billion cubic meters in 1980.

Soviet natural gas statistics are presented in table 9.

Petroleum.—The U.S.S.R. continued to be the second largest oil-producing country in the world. Crude oil output increased 6 percent over that of 1968 and totaled 328 million tons. About 28 percent of the total was exported, either as crude or as refinery products. In 1969, the return from these exports was 1,231 million rubles, 55 million rubles more than in 1968.

Oil was produced in a number of widely separated regions, of which the European U.S.S.R., was the most important. The Volga-Urals area produced more than 62 percent of the 1969 total. Production from Asiatic oilfields in West Siberia, Kazakhstan, Central Asia, and Sakhalin Island remained small, accounting for 14.5 percent of the total, but the development of

Table 9.—U.S.S.R.: Salient natural gas statistics
(Billion cubic meters)

Item	Actual				Planned and estimated			
	1965	1966	1967	1968	1969	1970	1975	1980
Production	129.4	144.7	159.2	171.0	182.8	196.0	280.0	370.0
Imports [1]	-----	-----	-----	1.0	2.0	5.0	13.0	14.0
Exports:								
To Communist countries	.4	.8	1.3	1.4	1.9	2.2	10.0	15.0
To non-Communist countries	-----	-----	-----	.3	.8	1.0	9.0	16.0
Total	.4	.8	1.3	1.7	2.7	3.2	19.0	31.0
Apparent consumption	129.0	143.9	157.9	170.3	182.1	197.8	274.0	353.0

[1] All from non-Communist countries.

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eastern oilfields was increasing, particularly in West Siberia and Kazakhstan.

All three primary methods of crude oil production (flowing, pumping, and gas lifting) were used and secondary recovery methods (repressuring and water flooding) were employed at many older fields in the Soviet Union. Increased production in 1969 was achieved through the use of a large number of rigs and the liberal use of manpower and materials. Capital investments in 1966–70 in the petroleum-extraction industry, were estimated at 8.22 billion rubles, of which about 6 percent is to be spent on public and communal construction.

Petroleum production is slated to rise to 350 million tons in 1970. The estimated level for 1975 is 445 million tons. Expansion of output will depend largely on development of new oilfields in West Siberia and Kazakhstan, although these regions will probably produce less than originally planned.

A realistic figure for Soviet crude oil production in 1980 might be around 540 million tons. By this time Soviet consumption will probably be around 340 million tons of products, giving a possible "surplus" of about 155 million tons of crude oil and products. Recent trade agreements commit a large share of Soviet crude oil to CEMA nations during the 1971–75 period, and other Communist countries have also requested more Soviet petroleum. During 1970–80 the consumption of oil in the CEMA nations (excluding the U.S.S.R.) is to plan to double, to an estimated 80 to 100 million tons. For the most part, crude oil will be produced only in the U.S.S.R. and in Rumania. Up to 1980 the demand for oil in CEMA nations will be met mainly by imports from the U.S.S.R., supplemented by annual imports of 10 to 15 million tons of crude oil from Arab and other non-Communist countries.

The U.S.S.R. continued to increase exports of crude oil and petroleum products even though internal demand was not satisfied. Exports rose from 64.4 million tons in 1965 to 90.8 million tons in 1969. Exports of crude oil and petroleum products are expected to rise to 97 million tons in 1970; estimated levels for 1975 and 1980 are 129 million and 156 million tons, respectively.

Exploration and Reserves.—According to Soviet sources 29 oilfields and 10 gasfields were discovered in the U.S.S.R. in 1969. These included 12 oilfields in the Volga region, seven oil and gasfields in the Ukraine; and others in Udmurt A.S.S.R., and in Tomsk Oblast'. Oil in commercial quantities was obtained for the first time in Urals Oblast'. In Kaliningrad Oblast', a second exploratory well confirmed the presence of commercial deposits.

The annual plan for increasing crude oil reserves was overfulfilled. However, the growth of crude oil reserves in the U.S.S.R. lagged behind the growth in extraction, and the reserve/production ratio for the country was declining. Particularly low ratios were indicated in the Ukraine, Azerbaydzhan, and Uzbek Republics, Kuybyshev and Saratov Oblast's, Krasnodar Kray, and others.[37]

In many regions the plan for drilling and for increasing drilling speeds was not met. For the whole industry during 1969, the target for development drilling was 94.3 percent fulfilled, and the goal to raise drilling speeds was 96.7 percent fulfilled. In exploration drilling, performance was poor. Unsatisfactory performance was reported by drilling enterprises of the Turkmen, Belorussia, and Groznyy associations, where plans were only 58 to 71 percent fulfilled.[38]

In support of the planned increment in output of crude oil, the volume of drilling is to be increased by 23 percent in 1970. This includes a growth of 30.1 percent in exploratory drilling and 19.7 percent in developmental drilling.

As of January 1, 1970, the proved, probable, and possible reserves of crude oil in the U.S.S.R. were estimated at 28 billion tons, including 3.6 billion tons of proved reserves (Soviet category A).

Oilfields and Crude Oil Production.—In 1969, about 450 oil and gasfields were in production, with about 55,000 operating wells. The largest increments in crude oil production were provided by the enterprises of Tyumen' Oblast', Tataria, Chechen-Ingush, Kazakhstan, Turkmenia, and Perm Oblast'. Production in Azerbaydzhan, Bashkiria, Orenburg Oblast', and Sakhalin Island did not reach plan targets. About 60 percent of all crude production in Azerbaydzhan came from offshore fields in the Caspian Sea. The U.S.S.R. plans to bring

[37] Geologiya nefti i gaze (Geology of Oil and Gas). Moscow, No. 6, June 1969, pp. 1–8.
[38] Pravda. Moscow, Jan. 31, 1970, p. 2.

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3,000 new developmental wells on stream during 1970.

Regional production of crude oil in the U.S.S.R. for 1969 and plans for 1970 are given in table 10.

Refining.—Estimated throughput of crude oil in Soviet refineries and products obtained in 1969 were 265 and 224 million tons, respectively. Nominal refinery capacity at yearend totaled 280 million tons per year, an increase of 14 million tons over the level of 1968. This was equivalent to about 90 prcent of the planned goal. The increase was achieved by expansion of the Angarsk, Kremenchug, Guryev, Polotsk, and other refineries.

Crude oil delivered to the refineries contained as much as 2 to 3 percent water and 5,000 milligrams per liter of chloride salt, but the norms permit only 0.1 percent water and 50 milligrams per liter of salts. As a result, refinery consumption and losses were over 13.4 percent of throughput. The total loss due to refining of insufficiently desalinated crude oil is more than 200 million rubles per year.[39]

Transportation.—About 70 percent of the total tonnage of crude oil and refinery products moved in the U.S.S.R. in 1969 was shipped by rail. The total length of trunk pipelines increased in 1969 by 2,700 kilometers to 36,800 kilometers, including 31,000 kilometers of crude oil lines and 5,800 kilometers of petroleum product lines. The average distance of pipeline deliveries of crude oil and products in 1969 was about 800 kilometers. Only 60 to 80 percent of total pipeline capacity was utilized. It is planned to complete 2,500 kilometers of additional pipelines in 1970.

In 1969 the following crude oil pipelines were completed: Yaroslavl-Kirishi 720 millimeters, 524 kilometers; 700-kilometer Uzhen-Guryev section of the 1,500-kilometer Mangyshalak-Kuybyshev line; Malgobek-Tikhoretskaya (484-kilometers); Aleksandrovskoye - Nizhnevartovsk - Ust' - Balyk (252 kilometers); Mozyr-Uzhgorod (300 kilometers); 200 kilometers of the "Friendship" pipeline; and Mozyr'-Brest (200 kilometers). Construction continued on the following trunk crude oil pipelines: Okha-on-Sakhalin-Komsomol'sk-on-Amur No. 2 (620 kilometers); Guryev-Kuybyshev (800 kilometers); Aleksandrovsk - Anzhero - Sudzhensk-Kransnoyarsk (1,300 kilometers); Ukta-Yaroslavl; and 1,220-millimeter Kuybyshev-Unecha N2 ("Friendship" No. 2).

The plans for pipeline construction in 1971–80 includes approximately 15,000 kilometers of crude oil pipeline, with a capacity of approximately 350 million tons of crude oil per year. There is a project for construction of a 6,500-kilometer Trans-Siberian pipeline, from Ust'-Balyk to Irkutsk and the Soviet Far Eastern port of Nakhodka. Nakhodka will be developed as a port for exports to Japan.

Trade.—Soviet exports of crude oil and petroleum products totaled 90.8 million tons in 1969, a 5-percent increase over 1968. Of the 1969 total, over 70 percent was crude oil; the remainder was products. Over 40 percent of total crude oil exports and 65 percent of product exports were shipped to non-Communist countries, and the rest went to other Communist countries. As usual, most of the exports were absorbed in 1969 by West European markets where they serve to pay for imports of industrial goods. Italy remained the largest buyer of Soviet oil.

Based on signed trade agreements and the latest Soviet forecasts, petroleum exports from the U.S.S.R. are expected to increase from 90.8 million tons in 1969 to 129 million tons in 1975, to 156 million tons in 1980.

Crude oil and product exports from the U.S.S.R. to Communist countries probably will rise from 47.6 million tons in 1969 to 73 million in 1975 and 92 million tons in 1980. Actual and estimated exports of crude oil and products from the U.S.S.R. to CEMA nations of Eastern Europe are presented in table 11.

Oil exports from the U.S.S.R. to non-Communist countries will continue to grow, perhaps attaining 40 million tons of crude oil and 24 million tons of products per year by 1980. In 1980, the Soviet Union may have to import about 10 million tons of crude oil from non-Communist countries in Africa and the Middle East.

Soviet petroleum statistics are presented in table 12.

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[39] Sotsialisticheskaya industria (Socialist Industry). Moscow, June 3, 1970, p. 1.

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Table 10.—U.S.S.R.: Crude oil production by region
(Million metric tons)

Republic and region	Actual 1969	Planned 1970
R.S.F.S.R.:		
Urals—Volga:		
Tataria	97.0	100.0
Bashkiria	42.8	40.0
Kuybyshev	34.7	34.8
Perm	15.1	16.0
Lower Volga	6.8	6.5
Orenburg	5.5	6.5
Other	2.6	3.2
Urals—Volga total	204.0	207.0
West Siberia:		
Tyumen Oblast'	19.7	27.1
Tomsk Oblast'	1.5	3.3
West Siberia total	21.2	30.4
Groznyy	18.5	20.5
Stavropol	5.5	5.9
Krasnodar	5.1	5.2
Komi A.S.S.R.	5.0	5.5
Other (including Sakhalin)	6.7	7.5
R.S.F.S.R. total	266.0	282.0
Azerbaydzhan	20.8	20.1
Turkmen	13.7	14.1
Ukraine	13.3	13.6
Kazakhstan	10.0	13.9
Belorussia	2.7	4.3
Other	1.5	2.0
U.S.S.R. grand total	328.0	350.0

Table 11.—U.S.S.R.: Exports of crude oil and products to CEMA nations of Eastern Europe
(Million metric tons)

	Czechoslovakia	Poland	Bulgaria	East Germany	Hungary	Total
1967:[1]						
Crude oil	7.4	3.6	2.7	6.2	2.8	22.7
Products	.5	1.9	1.8	.1	.6	4.9
Total	7.9	5.5	4.5	6.3	3.4	27.6
1968:[1]						
Crude oil	7.9	4.5	3.3	7.4	3.0	26.1
Products	.5	2.6	2.2	.2	.8	6.3
Total	8.4	7.1	5.5	7.6	3.8	32.4
1969:[2]						
Crude oil	10.3	6.0	4.0	8.1	3.6	32.0
Products	.8	2.1	1.9	.2	1.0	6.0
Total	11.1	8.1	5.9	8.3	4.6	38.0
1970:[2]						
Crude oil	10.0	7.0	5.0	7.0	4.0	33.0
Products	.9	2.2	2.0	.2	1.2	6.5
Total	10.9	9.2	7.0	7.2	5.2	39.5
1975:[2]						
Crude oil	14.5	11.0	10.0	14.0	6.5	56.0
Products	1.0	2.4	2.1	.2	1.3	7.0
Total	15.5	13.4	12.1	14.2	7.8	63.0
1980:[2]						
Crude oil	18.0	15.0	14.0	17.0	8.0	72.0
Products	1.1	2.6	2.2	.2	1.4	7.5
Total	19.1	17.6	16.2	17.2	9.4	79.5

[1] Reported.
[2] Estimated.

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Table 12.—U.S.S.R.: Salient petroleum statistics

(Million metric tons)

Item	Actual			Planned and estimated			
	1966	1967	1968	1969	1970	1975	1980
Crude oil:							
Domestic output	265.1	288.1	309.2	328.0	350	445	540
Imports	-----	(1)	------	------	------	5	10
Exports:							
To Communist countries	25.5	27.2	32.0	38.1	42	62	80
To non-Communist countries	24.8	26.9	27.2	25.8	27	35	40
Total	50.3	54.1	59.2	63.9	69	97	120
Crude product conversion:							
Crude oil to refineries	214.8	234.0	250.0	264.1	281	353	430
Refinery capacity	238.0	252.0	266.0	280.0	295	370	450
Refined oil:							
Output from crude	185.0	199.0	212.0	224.0	239	300	366
Natural gas liquids	3.0	3.7	4.1	4.7	5	8	12
Imports	1.7	1.4	1.0	1.1	1	(1)	(1)
Exports:							
To Communist countries	6.7	8.0	9.5	9.5	10	11	12
To non-Communist countries	16.6	16.7	17.5	17.4	18	21	24
Total	23.3	24.7	27.0	26.9	28	32	36
Apparent consumption	166.4	179.4	190.1	202.9	217	276	342

[1] Insignificant.

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The Mineral Industry of the United Arab Republic

By Henry E. Stipp [1]

The petroleum sector of the United Arab Republic's mineral industry again registered outstanding progress in production and exploration. It was estimated that by November crude oil output from the El Morgan, El Alamein, and Ras Ghareb fields totaled about 350,000 barrels per day. This was a 100,000-barrel-per-day increase compared with the 1968 output figure. Exploration continued at a high level with most activity located in the Western Desert area near Faghur, Abu Gharadig, and south of the Siwa Oasis. The United Arab Republic (U.A.R.) Government organization Egyptian General Petroleum Corp. (EGPC) and Phillips Petroleum Co. were developing a new oilfield at Umm Barka near the Libyan border and also discovered new natural gas resources in Abu Qir Bay northwest of Alexandria.

Other significant events in the metals and minerals sectors included plans to construct a primary aluminum production plant, the startup of a new steel strip mill, the discovery of high-grade tin ore deposits, plans to build four cement production plants, the inauguration of a new phosphate mine, discovery of a new medium-size deposit of phosphate rock, construction of a number of phosphate fertilizer production plants, and the discovery of new potash and coal deposits.

Several technological institutes including one for petroleum and mineral studies were to be established with technical and financial assistance from the U.S.S.R.

PRODUCTION AND TRADE

Statistics on production and trade are shown in the following tables.

[1] Physical scientist, Bureau of Mines, Washington, D.C.

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Table 1.—United Arab Republic: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
METALS				
Aluminum, metal, semimanufactures		6,539	7,870	NA
Copper, metal, semimanufactures and unwrought		5,441	5,191	NA
Iron and steel:				
Iron ore and concentrate	thousand tons	423	447	460
Pig iron	do.	• 200	NA	423
Steel ingots and castings	do.	• 200	190	• 490
Semimanufactures	do.	430	• 400	11,006
Lead and zinc mine output, gross weight		1,143	1,329	NA
Lead, semimanufactures		4,120	4,439	NA
Manganese, ore and concentrate, gross weight	thousand tons	75	4	4
Titanium:				
Ilmenite concentrate, gross weight		1,062	-----	204
Rutile concentrate, gross weight		6	-----	---
Zirconium, concentrate, gross weight		50	-----	---
NONMETALS				
Asbestos and vermiculite		r 11,937	2,602	NA
Barite		1,282	373	NA
Cement, hydraulic	thousand tons	2,754	3,146	3,618
Clays:				
Fire clay	do.	568	700	928
Kaolin (including china clay)		32,120	31,272	78,000
Refractory		-----	77,790	
Diatomite		-----	1,221	900
Feldspar, crude		-----	1,718	3,000
Fertilizer materials:				
Crude (natural): Phosphate rock	thousand tons	683	1,441	660
Manufactured:				
Nitrogenous, gross weight	do.	618	• 500	• 400
Phosphatic, including Thomas slag	do.	347	• 300	NA
Gypsum and anhydrite, crude	do.	545	r 570	470
Mica		• 500	NA	NA
Pigments, natural mineral, iron oxide		345	r 285	• 300
Pumice		r 7,122	• 8,000	• 5,000
Salt, marine	thousand tons	584	622	385
Sodium, caustic soda		18,944	• 19,000	NA
Stone, sand and gravel, n.e.s: Dimension stone:				
Basalt	thousand cubic meters	r 341	336	3,420
Dolomite	thousand tons	60	78	• 70
Granite	thousand cubic meters	12	27	• 30
Limestone and other calcareous	do.	3,218	4,000	4,300
Quartz		-----	20,602	13,000
Sand and gravel (including glass sand)	thousand cubic meters	r 2,945	r 3,766	2,741
Sandstone	do.	55	67	75
Sulfur, elemental, byproduct (recovered)		8,981	3,200	500
Talc, soapstone, steatite, and pyrophyllite		• 30,000	• 30,000	4,300
MINERAL FUELS AND RELATED MATERIALS				
Coal	thousand tons	111	-----	4
Coke:				
Oven and beehive	do.	• 275	• 280	311
Low temperature and gashouse	do.	40	30	35
Gas:				
Manufactured, all types	do.	35	28	• 30
Natural, liquefied (LPG)	thousand 42-gallon barrels	708	r 502	• 450
Petroleum:				
Crude oil	do.	39,547	62,206	89,598
Refinery products:				
Gasoline and naphthas	do.	6,258	r 6,523	8,868
Kerosine and jet fuel	do.	r 6,369	r 4,878	8,294
Distillate fuel oil	do.	8,639	r 7,242	8,633
Residual fuel oil	do.	21,556	r 20,282	9,850
Asphalt and bitumen, refinery	do.	596	r 868	NA
Petroleum coke	do.	350	68	NA
Total	do.	r 43,768	r 39,861	20,645

• Estimated. r Revised. NA Not available.

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Table 2.—United Arab Republic: Exports of major mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Ilmenite		2,208	-----
Iron and steel, semimanufactures		87	6
Magnetite		955	-----
Manganese ore	thousand tons	31	-----
Zircon		172	-----
NONMETALS			
Cement	thousand tons	353	876
Fertilizer materials:			
Crude: Phosphate rock	do	504	451
Manufactured:			
Nitrogenous		12,096	-----
Phosphatic		34,500	29,700
Gypsum, calcined	thousand tons	39	832
Salt	do	116	49
Talc and steatite		1,233	1,441
MINERAL FUELS AND RELATED MATERIALS			
Coke		-----	5,802
Petroleum:			
Crude	thousand 42-gallon barrels	3,534	5,628
Refinery products:			
Gasoline	do	3,316	3,166
Kerosine	do	340	305
Distillate fuel oil	do	1,475	1,371
Residual fuel oil	do	3,683	
Liquefied petroleum gas	do	4	-----
Asphalt and bitumen	do	38	19
Total	do	8,856	4,861

[1] From the Central Agency for Public Mobilisation & Statistics. Monthly Bulletin of Foreign Trade. June 1969, pp. 508.

Table 3.—United Arab Republic: Imports of major mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum, all forms		9,027	8,418
Copper, all forms		702	1,295
Gold	troy ounces	NA	6,828
Iron and steel:			
Scrap		51,874	35,864
Pig iron and ferroalloys		39,159	95,817
Semimanufactures		208,003	188,557
Lead, all forms		6,237	4,719
Mercury	76-pound flasks	NA	116
Tin, all forms	long tons	r 445	475
Zinc, all forms		1,451	5,137
Oxides, metallic, mainly for paint		212	2,978
NONMETALS			
Asbestos		5,527	3,959
Cement	thousand tons	78	12
Clays, mainly kaolin		7,748	6,168
Diatomite		NA	1,906
Feldspar		NA	1,000
Fertilizer materials:			
Nitrogenous	thousand tons	r 225	411
Phosphatic	do	41	3
Potassic		NA	2
Pigments, mineral		1,084	1,549
Pyrite, unroasted		75,083	64,658
Refractory materials, brick		4,180	5,335
Soda, caustic		NA	15,740
Stone for construction use, marble		170	-----
Sulfur, elemental		r 59,423	57,624
MINERAL FUELS AND RELATED MATERIALS			
Coal	thousand tons	480	505
Petroleum:			
Crude	thousand 42-gallon barrels	18,417	9,314
Refinery products:			
Gasoline	do	95	87
Kerosine	do	584	2,086
Distillate fuel oil	do	264	4,135
Residual fuel oil	do	8	
Lubricants	do	422	481
Other	do	10	16
Total	do	1,378	6,805

r Revised. NA Not available.

[1] From the Central Agency for Public Mobilisation & Statistics. Monthly Bulletin of Foreign Trade. June 1969, pp. 508.

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COMMODITY REVIEW

METALS

Aluminum.—In August the U.A.R. and U.S.S.R. Governments signed an agreement providing credits from the U.S.S.R. for construction of a 100,000-ton-per-year aluminum production plant.[2] The plant, designed to consume an estimated 1,750 million kilowatts per year of electric power from the Aswan Dam, was scheduled to convert alumina, imported chiefly from India and Yugoslavia, into aluminum. Apparently the plant will be built at Suez to facilitate import of alumina and will be completed by yearend 1974.

Gold.—Teams of geologists and mining specialists were investigating a number of ancient gold mines, principally along the Red Sea coast.[3]

Iron and Steel.—Expansion of the iron and steel complex at Helwan will cost an estimated $840 million.[4] This amount includes the cost of all complementary projects such as utilities, rail lines, roads, river port facilities, housing, and development of iron ore deposits. The new facilities were expected to increase steel output to 1.5 million tons per year and employ about 5,000 new workers. Three Egyptian companies will construct the new facilities at Helwan in two stages. The first stage was scheduled to be completed in mid-1973 and the second in 1975.

A ferrosilicon plant of 20,000-ton capacity was scheduled to be constructed by 1974 at Aswan, with credits supplied by the U.S.S.R. The plant was slated to consume about 200 million kilowatts per year of electric power produced at the Aswan Dam. In May, a new wide strip mill installed at Helwan by U.S.S.R. technicians began operating. The mill has a capacity of 300,000 tons per year.[5] A paper that described the mineralogy, geological history, and origin of the Bahariya Oasis iron ore deposits was published.[6]

Black sands in the Rasheed area of the Nile Delta were to be exploited to produce iron oxide pigments used in manufacturing paints.[7] About 200 persons will be employed on the project.

Tin.—Reportedly high-grade deposits of tin ore were discovered in the Aswan region and were being evaluated by specialists from the United Nations.[8] The deposits, located in the Gabel Moweilha and Wadi el Gimal regions, were discovered under a project financed by the U.A.R. Government ($1.8 million) and the United Nations Development Fund ($1.8 million).

Other Metals.—Columbium, molybdenum, tungsten, lead, zinc, iron, antimony, and titanium minerals were said to be present in the Aswan region.[9]

NONMETALS

Cement.—Plans were approved by the Government for construction of four cement plants with total production capacity of about 2.5 million tons per year.[10]

Fertilizer Materials.—A bed of phosphate rock 9.8 feet thick, containing tbout 300 million tons of from 48 to 64 percent calcium phosphate, was discovered in the New Valley near Abu-Tartour by a group of Polish mining specialists.[11] The Government conducted a detailed study of phosphate resources in the area between Isna and Kena.[12] Reserves of commercial-grade ore near Kena and neighboring areas were estimated at about 250 million tons. Exploration for phosphate deposits also was being carried out near Kusseir on the Red Sea and nearby areas. A number of phosphate fertilizer plants were scheduled for construction with financial support from the World Bank, Indian, Kuwaiti, and Iranian organizations.[13]

The 200,000-ton-per-year granulated superphosphate plant of Société Financière et Industrielle de Kafr-el-Zayat was near-

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[2] U.S. Interests Section, Cairo. State Department Airgram A-71, Aug. 15, 1969, p. 3.
[3] Mining Journal (London). U.A.R. V. 274, No. 7014, Jan. 23, 1970, p. 75.
[4] U.S. Interests Section, Cairo. State Department Airgram A-16, Jan. 24, 1970, p. 2.
[5] Metal Bulletin (London). No. 5426, Aug. 22, 1969, p. 24.
[6] Basta, Emile Z., and Homza I. Amer. El-Gidida Iron Ores and Their Origin, Bahariya Oasis, Western Desert, U.A.R. Econ. Geol., v. 64, 1969, pp. 424–444.
[7] The Financial Times (London). Egypt (United Arab Republic) Conflict of Priorities. No. 25,034, Dec. 22, 1969, p. 18.
[8] Mining Journal (London). Tin in U.A.R. V. 273, No. 6994, Sept. 5, 1969, p. 206.
[9] Work cited in footnote 8.
[10] U.S. Interest Section, Cairo. State Department Airgram A-98, Dec. 27, 1969, p. 2.
[11] U.S. Interests Section, Cairo. State Department Airgram A-27, Mar. 11, 1970, p. 3.
[12] Mining Journal (London). U.A.R. Mineral Resources Development. V. 274, No. 7014, Jan. 23, 1970, p. 75.
[13] Phosphorus and Potassium. No. 39, January–February 1969, pp. 6–7.

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ing completion at Assyut. With credits from the U.S.S.R., a 120,000-ton-per-year elemental phosphorus complex was scheduled for completion by yearend 1974 at Sebaiya near the Aswan Dam. A new phosphate rock mine at Abu Shgeili in the Western Desert was inaugurated in January. The mine was expected to produce 50,000 tons of ore per year starting in 1972 from a deposit estimated at 7 million tons. A paper was published that described the phosphate deposits of the Quseir to Safaga area and their mode of formation.[14]

Deposits of potash were discovered in Gamsa and the Nile Delta by the Egyptian Mining Organization.[15] A plant to produce 200,000 tons per year of calcium ammonium nitrate from coke oven gas was expected to be completed at Helwan in 1969.[16]

Salt.—Capacity of the salt works near Alexandria was to be increased from 250,000 tons to about 600,000 tons annually.[17]

MINERAL FUELS

Coal and Coke.—Deposits of coal reportedly were discovered in the Kharga Oasis, Wadi Arabia region.[18] The Helwan fertilizer plant of El Nasr Coke and Heavy Chemicals Co. was scheduled to begin operating at yearend 1969.[19] The plant was designed to use coke oven gas to produce ammonia.

Natural Gas.—Phillips Petroleum Co. and EGPC struck gas and condensates in a discovery well 15 miles northwest of Alexandria in Abu Qir Bay.[20] The well found two gas-bearing zones (one 49 feet thick and the other 92 feet thick) in Miocene sands below 8,200 feet. Tests on the lower zones gave a daily rate of 13 million cubic feet of gas and 300 barrels of 58° gravity condensate. Tests also were being conducted on the upper zone. The Abu Madi gasfield of International Egyptian Oil Co. will furnish natural gas for extraction of ammonia used in the manufacture of nitrogen fertilizers in a plant scheduled to be built at Talkha.

Petroleum.—Significant discoveries of new crude oil occurrences in the Western Desert area and rapidly increasing commercial production from recently developed fields highlighted petroleum activities in 1969. Phillips Petroleum Co. struck crude oil in a 10,000-foot discovery well located near Faghur.[21] The well is only 12 miles east of the Libyan-Egyptian border, giving rise to hopes of finding large producing fields like those in Eastern Libya. In January Phillips ceded to the EGPC 9,264 square miles of its concession area in the Western Desert. Pan American U.A.R. Co. also was scheduled to cede 25 percent of its concession area to the Egyptian company. Pan American U.A.R. Oil Co. discovered crude oil in a wildcat well located near Abu Gharadig, 70 miles southwest of El Alamein.[22] The well tested at a rate of 2,000 barrels daily of 33° gravity crude at 10,000 feet. Initial tests reportedly indicated a promising discovery. Phillips Petroleum Co. and EGPC began developing the Umm Barka field at mid-year.[23] Plans were made for drilling six producing wells, constructing gathering facilities, building a gas-oil separation plant, a 50-mile pipeline to the Mediterranean Sea, and an oil export terminal and storage facilities. The field was expected to produce at 60,000 barrels per day by late 1970.

Production from the oilfield at El Alamein was scheduled to increase to about 42,000 barrels per day from 37,000 barrels per day upon completion of a stepout well on a new northwest-southeast trend.[24] The well tested at 5,200 barrels per day on a 48- to 64-inch choke from a depth of 8,628 feet. The field could produce up to 50,000 barrels per day eventually. The El Morgan field in the Gulf of Suez was expected to produce 350,000 barrels per day by early

[14] El-Sayed El-Tarabili. Paleogeography, Paleoecology and Genesis of the Phosphatic Sediments in the Quseir-Safaga area, U.A.R. Econ. Geol., v. 64, 1969, pp. 172–182.
[15] Work cited in footnote 3.
[16] Nitrogen. Egypt. No. 57, January–February 1969, p. 10.
[17] Work cited in footnote 7.
[18] Work cited in footnote 3.
[19] Nitrogen. United Arab Republic. No. 61, September–October 1969, p. 7.
[20] Petroleum Intelligence Weekly. Mediterranean Find Extends Egypt's Growing Prospects. V. 8, No. 29, July 21, 1969, p. 2.
[21] Oil and Gas Journal. Phillips Backs Up Another Desert Strike. V. 67, No. 31, Aug. 4, 1969, p. 83.
[22] Petroleum Intelligence Weekly. V. 8, No. 33, Aug. 18, 1969, p. 7.
[23] Oil and Gas Journal. Egypt Pushing Development of Three New Fields. V. 67, No. 33, Aug. 18, 1969, p. 44.
[24] Oil and Gas Journal. Egypt's Western Desert Hopes Grow. V. 67, No. 21, May 26, 1969, p. 59.

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1970.[25] Increased output will result from installation of three new platforms and 22,000 feet of connecting pipelines. Total productive capacity of the entire field installation was estimated at 385,000 barrels per day.

In August Pan American U.A.R. Oil Co. signed an agreement with the Government for oil prospecting rights on 10,808 square miles of the Nile Valley near Assuit. North Sumatra Oil Development Corp. (NOSODECO), a Japanese firm, offered to develop an area off Ras Gharib on the Gulf of Suez under a contractor type arrangement.[26] The company would supply all equipment and technology and explore and develop the area for a share of any crude oil produced. EGPC and NOSODECO signed an agreement for petroleum exploration in a 38.6-square-mile area of the Gulf of Suez near Gareb Barib.[27] The agreement provided for a 3-year prospecting period and for a 15-year exploitation. Revenue and profit will be split on a ratio of about 75 percent for the Egyptian organization and 25 percent for the Japanese company.

A contract for construction of a 207-mile, 42-inch petroleum trunk pipeline was signed between the U.A.R. Government and an 11-member consortium of European companies.[28] The $175 million line, which will be located between Alexandria and a site south of Suez, was expected to be completed by May 1971. Initial capacity of the line will be 800,000 barrels per day but will increase to 1.2 million barrels per day by early 1972 with installation of new pumps and booster facilities. The French Government agreed to furnish material and scientific equipment for a petroleum institute.[29] The Petroleum Institute of France will give help on exploration and also training of Egyptian nationals.

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[25] Oil and Gas Journal. Revolutionary Work Ship Heads for Suez. V. 67, No. 30, July 28, 1969, pp. 96–98.

[26] Petroleum Intelligence Weekly. V. 8, No. 33, Aug. 18, 1969, p. 7.

[27] Chronique des Mines et de la Recherche Minière. No. 390, February 1970, p. 11.

[28] Oil and Gas Journal. Egypt Lets Contract for Sumed Pipeline. V. 67, No. 29, July 21, 1969, p. 38.

[29] Petroleum Intelligence Weekly. V. 8, No. 28, July 14, 1969, p. 7.

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The Mineral Industry of the United Kingdom

By F. L. Klinger [1] and Roman V. Sondermayer [2]

Overall output of the mining industry declined in 1969. This was due mainly to a 14-million-ton drop in production of coal compared with 1968, along with reduced output of iron ore and construction materials. A notable exception was the china clay industry, where output and exports increased.

Under the rationalization program in the coal-mining industry, more than 50 collieries were closed during the year and overall productivity increased about 4 percent. The declines in output of coal and iron ore were accompanied by increasing imports of crude oil and higher grade iron ores, as well as by a marked rise in output of natural gas from offshore fields in the North Sea.

In mineral development, several exploration and development projects were continued in the tin-mining districts of Cornwall, shaft- sinking began at one of the three potash-mining projects in Yorkshire, and an important new plant for recovery of fluorspar was under construction in Derbyshire. Intensive exploration for oil and gas in the North Sea yielded no significant discoveries in 1969, but substantial progress was evident in the construction of facilities for transport, processing, and distribution of natural gas from already-developed fields.

Legislative developments in 1969 and early 1970 were expected to greatly assist mineral exploration in the United Kingdom. In Northern Ireland, the Mineral Development Act of 1969 centralized ownership of mineral rights in the Ministry of Commerce, effective March 1, 1970. Excepting mineral deposits actually being mined on March 1, and deposits of aggregate materials such as common stone, sand, gravel, and clay, the Ministry will have authority to issue mining or prospecting licenses for any area in the country and can acquire land needed for mineral development. In Great Britain, responsibility for general policy on mineral development was centralized in the Ministry of Technology, and an important change in the tax laws affecting mineral royalities was expected in 1970. In 1969, mineral royalities received by landowners were treated as income subject to a tax rate of approximately 90 percent; the proposed changes would materially reduce the proportion taxable as income, providing greater incentive for royalty agreements.

In the mineral processing industries, there were important developments in aluminum, iron ore, iron and steel, tin, titanium, cement, and sulfuric acid. Petroleum refinery capacity increased to 106 million tons annually. In nuclear energy, the country's 14th powerplant was completed and five more were under construction.

With an improved trade balance in the last half of 1969, the Government reduced the import deposit requirement in December, from 50 percent to 40 percent of the value of imported goods.

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PRODUCTION

Production indices for mining and quarrying and manufacturing branches of the mineral industry were as follows (1963=100):

	1968	1969
Mining and quarrying	84.8	80.2
Manufacturing:		
Ferrous metals	111.2	116.2
Nonferrous metals	110.8	109.3
Nonmetallic mineral processing	127.3	127.8
Chemicals	140.8	149.2
Coal and petroleum products	126.4	139.3
All industry	119.8	122.9

Source: Central Statistical Office (London). Monthly Digest of Statistics. No. 296, August 1970, pp. 44–45.

In 1969, the lower index for mining and quarrying was generated mainly by reduced output of coal and iron ore. Overall productivity for coal increased, however, by about 4 percent compared with 1968. The increased index for ferrous metals reflects gains in output of steel. The reduced index for nonferrous metals seems not borne out by production statistics, although output of copper, nickel, and primary aluminum was less than in 1968. The slight increase in volume of nonmetallic mineral products reflected gains in output of pottery and glass; activity in housing and industrial construction was lower than in 1968, and the output of most building materials declined. Output of inorganic chemicals and fertilizers also declined; gains in the chemical sector were mainly in organic products such as synthetic resins and plastics. There was a 10-percent increase in output from petroleum refineries, and substantially increased deliveries of natural gas from the North Sea.

Detailed production data are summarized in table 1.

Table 1.—United Kingdom: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Aluminum:			
Primary	39	38	34
Secondary	r 182	r 190	213
Cadmium metal, including secondary—metric tons	209	207	235
Copper, refined:			
Primary (from imported blister)	36	50	49
Secondary	r 145	r 161	151
Iron and steel:			
Iron ore	12,944	r 13,935	12,300
Pig iron and blast furnace ferroalloys	15,395	16,695	16,652
Steel ingots and castings	24,276	r 25,865	26,845
Of which alloy steel	1,605	1,900	2,123
Steel semimanufactures:			
Sections, bars, rods	7,762	8,290	9,032
Hot-rolled plate sheet and strip [1]	5,314	6,106	6,533
Cold-rolled sheet and strip [1]	3,678	4,013	4,145
Other, including tubes, tinplate, rails, and castings	3,424	3,505	3,708
Lead:			
Mine output, metal content—metric tons	3,250	3,250	e 3,300
Metal:			
Primary (bullion)	27	32	39
Refined [2]	192	236	260
Magnesium metal, including secondary	4	4	e 4
Nickel metal, refined, including ferronickel	39	42	e 40
Tin:			
Mine output, metal content—long tons	r 1,499	r 1,827	1,649
Metal:			
Primary—do	23,317	24,933	26,399
Secondary—do	2,605	2,829	2,321
Zinc slab	104	143	151
NONMETALS			
Barite and witherite	37	26	e 30
Calcite	r 34	30	e 30
Cement	r 17,581	17,873	17,422
Chalk	r 18,321	19,010	18,617

See footnotes at end of table.

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Table 1.—United Kingdom: Production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969
NONMETALS—Continued			
Clays:			
China clay	r2,632	r2,807	2,828
Fire clay	r1,718	1,969	1,923
Potter's and ball clays	r693	740	e750
Other, including clay shale	r37,663	r39,823	e39,000
Diatomite	13	15	e15
Feldspar (china stone)	r80	81	e80
Fertilizers, manufactured: [3]			
Nitrogenous (N content)	733	855	841
Phosphatic (P_2O_5 content)	416	r441	460
Other, gross weight	2,846	2,982	2,836
Fluorspar [4]	154	r196	e200
Gypsum and anhydrite	4,593	4,789	4,595
Salt:			
Rock	703	1,105	1,417
Brine	1,413	1,501	1,519
Other [5]	4,997	5,181	5,582
Stone, sand and gravel:			
Chert and flint	58	55	55
Igneous rock and perlite	r34,220	r34,072	35,086
Limestone	r77,402	r81,184	82,175
Sandstone, including ganister	r10,036	r13,926	13,617
Slate	r85	78	e80
Sand and gravel:			
Sand for glassmaking	r1,446	1,529	e1,500
Other silica sand	1,138	2,009	NA
Molding sands	2,096	1,383	NA
Building and concrete sand thousand cubic yards	42,266	43,008	42,288
Gravel	52,769	51,506	49,932
Strontium minerals	7	8	e8
Sulfur elemental, recovered	47	47	NA
Talc, soapstone, and pyrophyllite	9	11	e11
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	163	184	198
Coal:			
Anthracite	4,112	3,942	3,691
Bituminous	170,787	r162,744	149,280
Coke:			
Metallurgical	r15,567	r16,507	16,853
Gashouse	r8,297	r4,667	3,011
Coke, breeze, coke-oven and gashouse	r2,954	2,651	2,278
Fuel briquets, all grades	974	1,040	1,158
Gas:			
Manufactured [6] million therms [7]	3,859	3,809	3,557
Natural million cubic feet	16,664	71,351	e178,673
Petroleum:			
Crude	r89	81	77
Refinery products:			
Gasoline:			
Aviation and wide cut	456	437	317
Motor	8,964	9,529	10,226
Kerosine, including white spirit	e4,044	4,861	2,670
Jet fuel			2,897
Gas and diesel fuel oil	14,229	17,144	19,477
Residual fuel oil	30,767	34,258	38,264
Liquefied petroleum gases	r1,026	r1,038	1,147
Naphtha and other feedstock	4,543	5,918	6,094
Lubricants, including grease	1,011	1,035	1,202
Paraffin	57	57	59
Bitumen	1,750	1,753	1,722
Other	1,116	1,015	1,009
Total	67,963	77,045	85,084
Refinery fuel and loss	5,565	6,051	6,508

e Estimate. r Revised. NA Not available.

[1] Includes coated sheets.
[2] Includes lead refined from imported bullion and secondary lead.
[3] Year ending May 31.
[4] Includes fluorspar recovered from old mine dumps.
[5] Salt in brine other than for saltmaking.
[6] Gas made at gasworks plus purchased coke-oven and refinery gas.
[7] 1 therm = 100,000 British thermal units.
[8] Gross production of which 99.7 percent was sold to consumers.
[9] Includes industrial spirit.

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TRADE

Trade in mineral commodities in 1969 continued to account for approximately 20 percent of the value of all exports and 32 percent of the value of all imports by the United Kingdom. The value of trade increased about $400 million in both exports and imports, and the trade deficit attributable to mineral commodities remained at approximately $2.8 billion. Nonmetallic mineral manufactures, nonferrous metals, and iron and steel were the principal commodities exported, while fuels (mainly crude oil) remained the major import group followed by nonferrous metals and nonmetallic mineral manufactures. Diamond accounted for most of the value of trade in nonmetallic commodities, and was an important element in the leading positions of the United States and Belgium as buyers, and of the Republic of South Africa as seller, in British mineral commodity trade. Canada continued to lead all countries in the value of exports to the United Kingdom owing to large shipments of ores and concentrates of iron, nickel, and platinum, and refined nonferrous metals.

Approximate values of the major mineral commodities traded in 1969 were as follows:

	Million dollars	
	Export	Import
Petroleum, crude	8	1,610
Diamond, gem	788	791
Iron and steel	684	[1] 627
Copper	263	671
Gold bullion [2]	424	526
Petroleum products	342	525
Silver and platinum-group metals [1]	209	398
Aluminum	57	[1] 262
Nickel	91	[1] 156
Lead and zinc	55	[1] 168
Tin	55	[1] 109

[1] Including ores and concentrates.
[2] Not included in mineral commodity trade statistics.

Sources: United Nations Statistical Office (New York), and Overseas Trade Accounts of the United Kingdom (December 1969).

United Kingdom trade in mineral commodities for 1967 and 1968 is detailed in tables 2 through 6.

Table 2.—United Kingdom: Exports [1] of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Oxide and hydroxide	22,191	17,123
Metal, including alloys:		
Unwrought	22,224	21,317
Semimanufactures	38,054	40,041
Bismuth metal	379	308
Chromium metal	649	1,070
Cobalt oxide and hydroxide	195	93
Copper metal, including alloys:		
Unwrought	115,123	102,897
Semimanufactures	71,937	74,339
Gold metal, unworked or partly worked:		
Bullion, refined thousand troy ounces	60,360	54,773
Other, including leaf do	125	203
Iron and steel:		
Metal:		
Scrap thousand tons	1,134	913
Pig iron, ferroalloys, and similar materials do	176	114
Steel, primary forms do	392	459
Semimanufactures:		
Bars, rods, angles, shapes, sections:		
Wire rod do	111	258
Other bars and rods do	263	366
Angles, shapes, sections:		
Heavy do	306	384
Light do	37	37
Universals, plates and sheets:		
Universals and heavy plates, uncoated do	395	392
Medium plates and sheets, uncoated do	109	73
Light plates and sheets, uncoated do	929	977
Tinned plates and sheets, uncoated do	401	369
Other coated plates and sheets do	256	227
Hoop and strip do	105	103
Rails and accessories do	162	149
Wire do	101	124
Tubes, pipes and fittings do	373	491
Castings and forgings, rough do	20	18

See footnotes at end of table.

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Table 2.—United Kingdom: Exports [1] of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS—Continued			
Lead:			
Oxides		5,207	5,081
Metal, including alloys:			
Unwrought		72,134	102,756
Semimanufactures		1,930	1,940
Magnesium metal, including alloys, all forms		1,139	908
Nickel metal, including alloys:			
Unwrought		30,714	34,014
Semimanufactures		9,633	11,728
Silver and platinum-group metals, including alloys:			
Platinum-group	thousand troy ounces	1,101	1,233
Silver	do	24,564	26,607
Tin:			
Oxides	long tons	286	355
Metals, including alloys:			
Unwrought	do	12,406	12,871
Semimanufactures	do	771	610
Zinc:			
Oxide and peroxide		r 4,639	5,634
Metal, including alloys:			
Unwrought		10,520	22,754
Semimanufactures		4,420	4,594
Other:			
Ore and concentrate		15,157	e 42,000
Ash and residues containing nonferrous metals		34,575	
NONMETALS			
Abrasives, natural, n.e.s		4,802	8,952
Asbestos, crude and waste		r 4,459	4,786
Cement	thousand tons	332	273
Clays and clay products (including all refractory brick):			
Crude clays, including china clay and others	do	2,145	2,298
Products:			
Refractory (including nonclay bricks)	do	151	171
Nonrefractory	do	59	72
Fertilizer materials, manufactured:			
Nitrogenous	do	373	345
Phosphatic	do	56	63
Other, including potassic	do	77	84
Lime		34,012	36,127
Salt	thousand tons	421	483
Stone, sand and gravel	do	670	1,106
Strontium minerals (celestite)		3,925	5,917
Other nonmetals, n.e.s.:			
Crude, including quartz, mica, and feldspar	thousand tons	340	413
Slag, dross and similar waste, not metal bearing	do	207	99
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		6,735	7,836
Carbon black		31,728	33,000
Coal, all grades, including briquets	thousand tons	1,882	2,760
Coke	do	773	853
Gas, natural and manufactured	do	12	36
Petroleum:			
Crude and partly refined	do	192	334
Refinery products:			
Gasoline (including natural)	do	1,453	1,341
Kerosine and jet fuel	do	917	1,089
Distillate fuel oil	do	3,870	4,732
Residual fuel oil	do	4,645	6,248
Lubricants	do	544	596
Mineral jelly and wax		4,656	3,889
Other, including bitumen and other residues	thousand tons	241	213

e Estimate. r Revised.
[1] Excludes reexports.

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Table 3.—United Kingdom: Reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum metal, including alloys, all forms	838	1,500
Copper metal, including alloys, all forms	3,489	3,108
Lead metal, including alloys, all forms	3,381	1,644
Mercury, 76-pound flasks	3,162	3,513
Nickel metal, including alloys:		
Unwrought	5,539	7,128
Semimanufactures	478	125
Tin metal, including alloys, all forms, long tons	23	21
Zinc metal, including alloys, all forms	96	694
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude oil, thousand tons	578	102
Refinery products:		
Gasoline (including natural)	6,645	5,735
Kerosine and jet fuel	4,261	NA
Distillate fuel oil	6,375	56,763
Residual fuel oil	10,870	30,951
Lubricants	143	NA
Liquefied gases	3,579	1,971

NA Not available.

Table 4.—United Kingdom: Principal destinations of selected mineral commodity exports, 1968

(Thousand metric tons)

Commodity	Quantity
METALS	
Copper, unwrought, total [1]	103
West Germany	28
Italy	17
Netherlands	14
United States	13
Semimanufactures, total	74
United States	12
Ireland	6
Poland	5
Netherlands	4
Israel	3
Iron and steel, scrap, total	913
Italy	268
Spain	219
Netherlands	142
Steel, primary forms, total	459
Spain	171
United States	126
Semimanufactures, total	3,968
United States	833
Iran	196
Sweden	195
Italy	133
Norway	130
Denmark	111
Spain	90
Lead, unwrought, total [1]	103
West Germany	36
United States	20
NONMETALS	
Clays, crude, total [2]	2,298
Italy	423
West Germany	345
Sweden	235
France	232
Finland	215
MINERAL FUELS AND RELATED MATERIALS	
Coal, total	2,760
West Germany	761
Netherlands	633
France	440
Italy	266
Coke, total	853
Norway	445
Sweden	132
Petroleum refinery products, total	14,222
Sweden	3,450
Denmark	2,850
United States	1,580
Norway	1,181

[1] Including alloys.
[2] Figures reported for countries of destination include small quantities of other unspecified refractory minerals.

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Table 5.—United Kingdom: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum:			
Bauxite and concentrate	thousand tons	459	442
Metal, including alloys:			
Scrap	do.	14	13
Unwrought	do.	308	362
Semimanufactures	do.	31	39
Bismuth metal, including alloys:			
Metal		340	326
Alloys		266	160
Cadmium metal, including alloys, all forms		1,097	1,268
Chromite	thousand tons	100	160
Cobalt:			
Oxide and hydroxide		954	955
Metal, including alloys, all forms		1,635	1,560
Copper:			
Ore and concentrate		52	1,402
Metal, including alloys:			
Scrap		2,036	8,058
Unwrought:			
Unrefined	thousand tons	420	459
Refined (blister)	do.	31	
Semimanufactures		7,255	11,970
Gold:			
Metal, unworked and partly worked, fine basis:			
Refined	thousand troy ounces	33,735	44,637
Unrefined	do.	821	819
Iron and steel:			
Ore and concentrate, except roasted pyrite	thousand tons	15,781	17,534
Roasted pyrite	do.	557	362
Metal:			
Scrap	do.	3	3
Pig iron, including cast iron, sponge iron, powder and shot	do.	284	241
Ferroalloys:			
Ferromanganese	do.	75	67
Other	do.	180	213
Steel, primary forms	do.	309	591
Semimanufactures:			
Bars, rods, angles, shapes, and sections:			
Wire rod	do.	148	155
Other bars and rod	do.	352	376
Angles, shapes, and sections	do.	34	36
Universals, plates and sheets:			
Heavy and medium plates and sheets, uncoated	do.	99	177
Light plates and sheets, uncoated	do.	384	426
Other coated plates and sheets	do.	76	74
Hoop and strip	do.	39	63
Wire	do.	7	8
Tubes, pipes, and fittings	do.	204	258
Castings and forgings, rough	do.	2	2
Lead:			
Ore and concentrate	do.	33	60
Metal, including alloys:			
Scrap		2,705	1,914
Unwrought	thousand tons	188	218
Semimanufactures		431	1,022
Magnesium metal, including alloys:			
Scrap		67	481
Unwrought		6,157	6,186
Manganese ore and concentrate	thousand tons	411	482
Mercury	76-pound flasks	17,637	18,237
Molybdenum ore and concentrate		9,126	8,401
Nickel:			
Matte, speiss, and similar materials		59,528	59,232
Metal, including alloys:			
Scrap		4,646	4,362
Unwrought		29,900	31,053
Semimanufactures		1,665	1,366
Platinum-group metals, including alloys, all forms	thousand troy ounces	130	158
Selenium, elemental		141	159
Silicon, elemental		r 11,440	14,597
Silver bullion, fine basis:			
Refined	thousand troy ounces	50,575	72,706
Unrefined	do.	13,227	53,171
Titanium ore and concentrate:			
Ilmenite	thousand tons	254	254
Other	do.	17	21
Tin:			
Ore and concentrate	long tons	62,806	67,805
Metal, including alloys:			
Scrap	do.	995	1,035
Unwrought and semimanufactures	do.	8,221	9,465

See footnotes at end of table.

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Table 5.—United Kingdom: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS—Continued			
Tungsten ore and concentrate		6,250	6,284
Zinc:			
Ore and concentrate	thousand tons	262	336
Metal, including alloys:			
Scrap		3,966	3,505
Unwrought	thousand tons	164	173
Semimanufactures		604	1,710
Zirconium ore and concentrate		25,083	49,343
Other:			
Ores and concentrate	thousand tons	r 17	23
Ash and residues containing nonferrous metals	do	92	63
Base metals, including tungsten, molybdenum, and tantalum		13,910	15,255
NONMETALS			
Abrasives, natural, excluding diatomite	thousand tons	103	80
Asbestos, crude	do	171	179
Barite and witherite	do	52	33
Borax	do	15	13
Cement	do	364	330
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s	do	99	[1] 101
Products:			
Refractory (including nonclay bricks)	do	54	59
Nonrefractory	do	19	21
Cryolite and chiolite		1,558	(2)
Diatomite and other infusorial earths	thousand tons	47	43
Feldspar and fluorspar	do	112	[3] 131
Fertilizer materials:			
Crude:			
Nitrogenous	do	14	14
Phosphatic	do	1,616	1,865
Potassic	do	43	37
Other	do	28	27
Manufactured:			
Nitrogenous	do	396	380
Phosphatic	do	91	75
Potassic	do	768	810
Other, including mixed	do	285	315
Graphite, natural		8,638	10,244
Gypsum and plasters	thousand tons	146	191
Magnesite	do	62	76
Mica, crude, including splittings and waste	do	9	13
Pigments, mineral, crude, natural		5,277	NA
Pyrite (gross weight)	thousand tons	251	220
Salt	do	37	33
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	do	34	31
Worked	do	28	28
Dolomite	do	22	
Gravel and crushed rock	do	183	e 432
Quartz and quartzite	do	9	
Sand, excluding metal bearing	do	204	212
Sulfur, elemental	do	731	791
Talc, steatite, soapstone, and pyrophyllite	do	51	51
Other nonmetals, n.e.s.:			
Crude	do	310	347
Slag, dross, and similar waste, not metal bearing	do	25	NA
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	do	69	66
Carbon black	do	12	15
Coal and coke, including briquets	do	70	71
Gas, natural and manufactured	do	977	1,095
Petroleum:			
Crude and partly refined	do	74,641	83,014
Refinery products:			
Gasoline (including natural)	do	4,799	4,748
Kerosine and jet fuel	do	5,390	5,837
Distillate fuel oil	do	4,478	3,554
Residual fuel oil	do	8,607	7,207
Lubricants	do	650	640
Mineral jelly and wax	do	201	189
Other, including petroleum coke	do	85	e 75

e Estimate. r Revised. NA Not available.

[1] Includes andalusite, kyanite, etc.

[2] Included in feldspar and fluorspar.

[3] Includes nepheline syenite.

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Table 6.—United Kingdom: Principal sources of selected mineral commodity imports, 1968

(Thousand metric tons unless otherwise specified)

Commodity	Quantity	Commodity	Quantity
METALS		METALS—Continued	
Aluminum:		Mercury—Continued	
Bauxite, total	442	Spain—76-pound flasks	1,621
Ghana	210	Tin ore and concentrate, total—long tons	67,805
Greece	98	Bolivia—do	58,470
Metal, unwrought, total [1]	362	Zinc:	
Norway	146	Ore and concentrate, total	336
Canada	121	Australia	179
Copper, unwrought, all forms, total [1]	459	Unwrought, total [1]	178
Zambia	175	Canada	98
Chile	106	Bulgaria	14
Silver, unrefined and refined value, thousands	$278,184	NONMETALS	
Trucial states, Muscat and Oman do	$87,997	Fertilizer materials:	
United States—do	$87,853	Crude, phosphates, total	1,865
Australia—do	$26,109	United States	275
Mexico—do	$20,151	U.S.S.R.	161
France—do	$9,178	Senegal	143
Iron and steel:		Manufactured, potassic, total	810
Iron ore, total	17,584	East Germany	217
Sweden	4,584	Canada	186
Canada	3,347	France	139
Mauritania	1,875	Sulfur, elemental, total	791
Venezuela	1,695	Mexico	311
U.S.S.R.	1,499	France	288
Steel, primary forms, total	591	United States	114
U.S.S.R.	131	MINERAL FUELS AND RELATED MATERIALS	
Spain	106	Petroleum:	
Semimanufactures, total	1,575	Crude, total	83,014
Netherlands	202	Libya	21,921
Sweden	189	Kuwait	18,491
West Germany	188	Iran	9,611
Belgium-Luxembourg	158	Saudi Arabia	9,065
Norway	132	Refinery products, total	•22,250
France	95	Italy	4,674
Mercury, total [2]—76-pound flasks	18,237	Netherlands	4,221
Italy—do	7,133	France	2,721
Yugoslavia—do	3,301	Spain	1,776
		Venezuela	1,195
		Belgium-Luxembourg	1,205

• Estimate.
[1] Including alloys.
[2] As reported by source countries.

COMMODITY REVIEW

METALS

Aluminum.—The British Aluminium Co., Ltd. (BACO), Alcan Aluminium Ltd., and Anglesey Aluminium Ltd. continued construction of aluminum smelters in 1969. All three plants were expected to be in production in 1971. Annual output capacities of the BACO and Anglesey plants, at Invergordon and Holyhead, respectively, will be 100,000 tons each; capacity of the Alcan plant at Lynemouth will be 60,000 tons in 1971 and 120,000 tons in 1974. The Anglesey company is owned 40 percent by Kaiser Aluminum & Chemical Corp., 33 percent by Rio Tinto Zinc Corp. Ltd. (RTZ), and the remainder by British Insulated Callenders Cables Ltd. (BICC).

The only primary aluminum smelters operating in 1969 were BACO plants at Lochaber and Kinlochleven, with nominal annual output capacities of 25,000 tons and 10,000 tons, respectively. Most British requirements for aluminum continued to be supplied by imports, largely from Norway and Canada. Imports of ingot, semimanufactures, and scrap totaled 417,000 tons in 1969 (413,000 tons in 1968). Exports were virtually unchanged from the 1968 level.

Imports of bauxite increased to 478,000 tons in 1969. The major suppliers continued to be Ghana (273,000 tons), Greece (75,000 tons), and France (71,000 tons). Most of the bauxite was processed in alumina plants of BACO located at Burntisland (Fife) and Newport (Monmouthshire). Trihydrate ore (mainly from Ghana) is processed at Burntisland, while the Newport plant processes both monohydrate and trihydrate ores. The two plants had a combined annual production capacity of about 150,000 tons of alumina.

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Output of secondary aluminum (not including content of primary metal) was slightly less than 210,000 tons in 1969 (188,000 tons in 1968). Despatches of unwrought metal to consumers included 396,000 tons of primary aluminum and 226,000 tons of secondary metal. Despatches of semifabricated aluminum were estimated at 497,000 tons.

Approximate consumption of aluminum in the United Kingdom (as indicated by despatches) in 1968 was 439,500 tons, distributed by end use as follows:

Consuming sector	Consumption (thousand tons)	Percent of home market
Transport vehicles	135.3	30.7
Engineering (mechanical and electrical)	91.6	20.8
Domestic and office appliances	47.7	11.0
Packaging	36.7	8.4
Building and construction	36.4	8.3
Metals production	15.9	3.6
Chemicals, food, agriculture	10.4	2.4
Other	65.5	14.8
Total	439.5	100.0

Source: Aluminium (Duesseldorf). V. 46, No. 1 January 1970, p. 41.

Alcoa (Great Britain) Ltd., owned 75 percent by Aluminum Co. of America and 25 percent by Elkem A/S of Norway, was planning to build a "major rolling mill complex" for light-gage, hot- and cold-rolled sheet (primarily canstock). Neither site nor capacity of the plant was announced, but a possible location was adjacent to the company's semimanufacturing plant at Waunarlwydd, Wales.

A merger between Alcan Industries Ltd. and James Booth Aluminium, Ltd. was announced at yearend. The new company, Alcan Booth Industries Ltd., had a productive capacity of about 130,000 tons of aluminum semimanufactures annually, reportedly the largest in the United Kingdom (the productive capacity of BACO was about 100,000 tons annually). Alcan owned 75 percent of the new company, and 25 percent was owned by Kaiser Aluminum & Chemical Corp. Alcan had acquired a 50-percent interest in the Booth firm in late 1968. Sales of aluminum by Alcan in the United Kingdom totaled 191,000 tons in 1969, compared with 174,000 tons in 1968.

Copper.—Production, trade, and consumption of copper, which in the United Kingdom is based almost entirely on imported metal, was largely unchanged from 1968 levels. The share of electrolytic copper in production of refined copper rose to 40 percent in 1969, compared with about 27 percent in the previous 3 years. Production of copper and alloy semimanufactures increased 1.8 percent to 738,000 tons and exports rose 14 percent to 85,000 tons. Exports of unwrought copper to the United States declined to almost zero in 1969, while exports to mainland China increased by more than 20,000 tons.

Total consumption of copper in the United Kingdom increased 1.5 percent to 685,000 tons, of which 80 percent was primary and secondary refined metal and 20 percent was copper in scrap.

Gold.—A prospecting license for gold was obtained by Geochemical Re-Mining Ltd. in the Dolgelly area of North Wales. The area includes the St. David's and Gwynfynydd (Gwyn) mines (last worked in 1965 and 1916, respectively) which produced about 116,000 ounces of gold during 1844–1957. Average gold content of ore mined in the district was about 0.45 ounce per ton.

Iron Ore.—The decline in output of iron ore in 1969 was due mainly to a 14-percent drop in production from the Northamptonshire ironstone field between Lincoln and Towcester. Northamptonshire ore, averaging about 31 percent iron provided about 60 percent of the national output, while the Frodingham ironstone (about 21 percent iron) of North Lincolnshire provided most of the remainder. These ores consist mainly of chamosite and geothite. Output of hematite ore (about 49 percent iron) from Cumberland and South Wales (Glamorgan) continued to decline, to a total of 285,000 tons in 1969. Ninety-one percent of all iron ore mined in 1969 was produced from open pits.

Imports of higher grade foreign ores continued to rise, to 18.5 million tons in 1969. Sweden and Canada remained the principal suppliers. Imports from Norway rose to 2 million tons, twice the quantity reported for 1968. Consumption of iron ore for ironmaking totaled 30.1 million metric tons, supplied 41 percent by domestic ores and 59 percent by imports.

The United Kingdom's first deep-water iron ore terminal was completed at Port Talbot in late 1969. The $48 million ter-

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minal can accommodate ships of 100,000 deadweight tons. Construction of two more terminals, a $27 million facility at Immingham on the Humber estuary and a $36 million installation on the Tees, were scheduled for completion in 1972. The latter two terminals are expected to accommodate 100,000-ton ships, with facilities for 200,000-ton vessels eventually to be built at Teesside. Construction of a fourth terminal, a $31 million installation at Hunterston on the Clyde River in Scotland, may be built to supply steelworks of the British Steel Corp. (BSC)'s Scottish and Northwest Group. The Immingham terminal, to be operated by BSC, the National Coal Board, and the British Transport Dock Board, is expected to permit annual imports of 6 million tons of iron ore and exports of 3 million tons of coal. The Teesside facility is designed to handle imports of 10 million tons of ore annually, although anticipated requirements were expected to be about 7 million tons.

Iron and Steel.—Unexpectedly low output of iron and steel and strong domestic demand led to a 6-percent drop in steel exports and an 8-percent rise in steel imports in 1969. Net exports of scrap were 650,000 tons less than in 1968. Home consumption of steel rose to an estimated 24.1 million tons (ingot equivalent), about 5 percent more than in 1968.

Output of metal was about 750,000 tons less than expected in 1969, owing to labor disputes. The principal work stoppage occurred at the Port Talbot works of the BSC, where a loss in production of about 260,000 tons of steel was sustained during a strike of 1,300 blast furnacemen from June 27 to August 24. The main problem, involving recognition of unions representing staff workers in the industry, was at least partly resolved, and good progress was reported in negotiations of productivity agreements with other unions (especially the Iron and Steel Trades Confederation) so that a high level of steel production—about 28 million tons—was expected in 1970. BSC accounts for about 90 percent of the national output of iron and steel.

A serious problem was the low level of domestic steel prices. This was partly responsible for a $50 million deficit sustained by BSC in 1969 despite a trade surplus of over $200 million. Two price increases, averaging about 5 percent in June and 1.75 percent in November, were allowed in 1969. An additional increase was likely at yearend, since home prices were still substantially below those in European Economic Community (EEC) and American markets.

BSC continued programs to increase productivity in the steel industry. Proposals to rationalize or cease operations at 30 separate works, involving a total reduction of 12,000 jobs, were made by the corporation during the year. At the same time, BSC continued to invest heavily in new plants, particularly in oxygen steelworks, as part of its objective to raise annual productive capacity to about 32 million tons of steel in 1973 compared with about 26 million tons in 1969. Total planned investment during 1969–75 was more than $2,000 million.

Major plant developments in 1969 included installation of two 300-ton Linz-Donawitz (LD) converters at the Port Talbot works, and near completion of the new LD works at Lackenby, with two 240-ton converters installed and a third one planned. Production at Lackenby was expected to start in 1970, with an annual output capacity of 2 million tons of steel. At the Scunthorpe works, three 300-ton LD converters are scheduled to replace all steelmaking at the Appleby-Frodingham and Redbourne divisions. By 1973, a third LD converter will be added to the Ravenscraig works in Scotland and three 165-ton converters will replace existing steelmaking vessels at the Spencer works in Wales. Excluding new capacity installed at Port Talbot, these projects will increase LD capacity in the United Kingdom by 6.6 million tons annually. BSC also planned to gradually eliminate crude steel production at Ebbw Vale, while expanding the works' rolling capacity to 1.56 million tons annually. BSC hoped to concentrate crude steel production at Port Talbot, Scunthorpe, and Teesside. A fourth center may be selected in the Midlands for production of electric furnace steel.

Most crude steel (52.8 percent) was made in open hearth furnaces, but the shares produced by oxygen converters (28.8 percent) and electric furnaces (18.4 percent) continued to rise. Output by process in 1969 is summarized in the following tabulation:

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Process	Production (thousand metric tons)
Open hearth	14,175
Converter:	
Kaldo	755
LD	5,965
Other	1,010
Electric:	
Arc	4,808
Induction	132
Total	26,845

Source: Iron and Steel Industry (London). Monthly Statistics. V. 15, No. 7, July 1970, table 11.

In other developments, the country's first argon-oxygen converter will be installed by 1971 by Spartan Steel Alloys, Ltd. at Birmingham. The Spartan company, a producer of stainless steel (13,000 tons in 1969), expects to increase output by 50 to 100 percent. A $20 million electric steelworks, to be completed in 1971, will be built in Kent by Sheerness Iron and Steel Co. Ltd. On August 4, 1969, BSC began transporting hot metal from Teesside to the Consett Works, a distance of 63 miles; it was the first time hot metal had been transported for any appreciable distance in the United Kingdom.

Lead and Zinc.—No lead or zinc mines were known to be operating in 1969. Output of lead concentrates was mainly a by-product of fluorspar mining in Derbyshire. Exploration and development underway at old mines in North Wales and the Lake District may result in some production in the near future.

Domestic output and consumption of both metals continued to be based largely on imports of concentrates and metal and on recovery of metal from secondary sources. The principal producer of primary metal was the Imperial Smelting Corp. Ltd. at Avonmouth, a subsidiary of RTZ, which produced 111,000 tons of slab zinc and 40,000 tons of lead bullion in 1968. The largest refiner of crude lead was Britannia Lead Co. Ltd., a wholly owned subsidiary of Mount Isa Mines Ltd. of Australia, whose works at Northfleet, Kent, had a processing capacity of 140,000 tons annually.

Imports of lead in 1969 rose to 71,000 tons of concentrates and 230,000 tons of metal including alloys. Australia supplied 25 percent of the concentrate and 75 percent of the metal. Imports of zinc concentrates (334,000 tons) and metal (163,000 tons) were slightly below 1968 levels; Australia supplied 57 percent of the concentrate, while Canada continued to supply about 60 percent of the metal. Exports of lead increased by 40 percent compared with 1968, while exports of zinc declined by 15 percent.

Total consumption of lead dropped to 367,000 tons in 1969, continuing a decline started in 1965, while that of zinc rose to about 382,000 tons, approximately the 1964 level. These figures include 275,000 tons of refined lead and 288,000 tons of slab zinc.

The principal end uses of lead and zinc in 1969, in percent of total consumption, follow:

End use	Percent
Lead:	
Batteries	27.0
Cables	18.1
Rolled and extruded [1]	18.9
Tetraethyl	10.8
All others	25.2
Total	100.0
Zinc:	
Brass	30.4
Galvanizing	25.8
Die-casting alloys	20.2
All others	23.6
Total	100.0

[1] Including shot.

Source: World Metal Statistics (London). V. 23, No. 7, September 1970.

Tin.—The slight rise in output of mine tin in 1969 was due mainly to a 20-percent increase reported for Geevor Tin Mines, Ltd. in Cornwall. The Geevor company processed about 90,000 tons of ore in 1969, compared with 110,000 tons processed by South Crofty, Ltd., the other major Cornish producer. Output of tin concentrates by South Crofty dropped slightly to 1,114 tons (1,148 tons in 1968), while Geevor produced 1,008 tons (824 tons in 1968).

The remaining production was largely recovered from old mine tailings. At Roscroggan, Cornish Tin Smelting Co. Ltd. recovered 283 tons of tin concentrate from 62,000 tons of tailings, and near Truro, Hydraulic Tin Ltd. recovered an unspecified quantity of concentrate from about 100,000 tons of material.

Exploration and development work was continued at several locations in Cornwall. Diamond drill samples of a tin-tungsten prospect, being explored by International Mine Services on the Cornwall-Devon border, reportedly averaged 0.74 percent tungsten and less than 1 percent tin. At the Pendarves property, Camborne Tin Mines Ltd. completed 3,000 feet of underground

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development work at depths between 450 and 756 feet; sampling indicated an average ore grade of 0.96 percent tin over a vein width of 5 feet. At the Mount Wellington property, Cornwall Tin and Mining Corp. began sinking a 15-foot-diameter, 600-foot shaft; plans were to complete the shaft in 1970 and begin 3,000 feet of drifting on the vein at the 550-foot level; samples obtained from this work will determine whether the company will launch a $6 million program to develop a mine and mill. Geevor Tin Mines Ltd. increased proved ore reserves to 225,000 tons averaging about 1.1 percent tin. South Crofty, Ltd., was engaged in a $1.6 million project designed to double production capacity to 900 tons of ore per day in 1971. In a $14.4 million development west of Truro, Wheal Jane Ltd., a subsidiary of Consolidated Gold Fields, Ltd., began construction of "The Janes" mine and mill, with completion scheduled for mid-1971. Output of the mine will be 150,000 tons of ore annually; ore reserves were reported to be 5 million tons averaging 1.25 percent tin.

There were significant developments in the United Kingdom's primary tin-smelting industry. Williams Harvey and Co., Ltd. completed an $8.4 million plant at Kirkby, Lancashire. Processing capacity of the smelter, which can handle several types of ore, was 20,000 to 25,000 metric tons of primary tin. At North Ferriby, Yorkshire, Capper Pass and Son Ltd. was investing $17.4 million to double the capacity of its Melton works by 1975. Current annual capacity in metric tons was 10,000 tons of ore and 8,000 tons of primary tin. The first stage of the expansion project, involving 60 percent of the total investment, was scheduled for completion in 1970. The Capper Pass company was a subsidiary of RTZ.

Imports of tin concentrates rose to 76,000 tons in 1969, with 88 percent coming from Bolivia. Exports of metal increased to 17,275 tons, 28 percent above the 1968 level.

Titanium.—Two plants for production of titanium dioxide by the chloride process were under construction in 1969. The plants included a 40,000-ton-per-year unit at Stallingborough for Laporte Industries (Holdings) Ltd., and a 30,000-ton-per-year unit at Greatham for British Titan Products Co. Ltd. (BTP). Both plants were scheduled for completion in 1970. The new facilities will raise the companies' annual output capacity for titanium dioxide (via sulfate and chloride processes) to 95,000 tons for Laporte and to 250,000 tons for BTP.

Imports of titanium ores and concentrates by the United Kingdom in 1969 increased to 260,000 tons of ilmenite and 45,000 tons of rutile and other minerals.

Production of titanium sponge from titanium tetrachloride was continued at Wilton, Yorkshire, by the Mond division of Imperial Chemical Industries, Ltd. (ICI). Output capacity, which was about 3,000 tons annually in 1968, may have increased in 1969. Imperial Metal Industries Ltd. (IMI), which is reported to have Europe's largest facility for melting and fabricating titanium at Wilton near Birmingham, increased output capacity of the Kynoch works to 5,250 tons of titanium annually. Melting capacity of IMI was 3,500 ingot-tons in 1968. IMI, a subsidiary of ICI, is supplied with titanium sponge from Wilton.

NONMETALS

Barite and Witherite.—Output of barite in 1969 came mostly from the Muirshiel mine operated by RTZ in Renfrewshire, Scotland, and from the Glebe fluorspar mine in Derbyshire (see Fluorspar). An estimated 6,000 tons was produced by the Closehouse mine in the Northern Pennines. The Muirshiel mine was expected to close in the near future.

In Northumberland, the Settlingstones witherite mine was closed in March 1969. Originally worked for galena, the mine had been worked almost solely for witherite since 1873 and had provided most of the world's supply. Production of witherite in the United Kingdom in 1968 was about 5,000 tons.

Celestite.—Bristol Mineral Co., the sole producer of celestite in the United Kingdom, was acquired in 1969 by English China Clays Ltd. The move was expected to improve competitiveness of British celestite on the international market, owing to the processing experience, marketing facilities, and financial position of the purchasing company. Increasing competition was evidenced in 1969 by rising production in Mexico and Spain and development of large deposits in Canada. British exports of celestite to the U.S. market (principally

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to E.I. du Pont de Nemours & Co., Inc.) dropped about 9 percent in 1969 (to 3,764 tons), although U.S. imports (about 24,000 tons) were twice the level of 1968.

All celestite production was obtained from deposits near Yate in south Gloucestershire. Minimum reserves were estimated at 150,000 tons.

Cement and Other Construction Materials.—A major new cement works was under construction at Northfleet, Kent. The works, to be completed in 1971, will include six kilns with an aggregate production capacity of 4 million tons annually. Principal raw material for the works will be chalk, quarried at Swanscombe 3 miles from Northfleet, and clay quarried at Ockenden, 7 miles from Swanscombe. The clay will be transported by pipeline under the Thames River to Swanscombe, where chalk-and-clay slurry will be prepared and piped to the works at Northfleet. Operating company is the Blue Circle Group of Associated Portland Cement Manufacturers Ltd.

Production capacity for cement in the United Kingdom at yearend 1969 was estimated at 20.5 million tons annually.[3]

Sand and Gravel.—Exploitation of offshore resources of sand and gravel continued to increase in 1969. Marine-dredged sand and gravel was estimated to account for at least 10 percent of the national output, and constituted as much as 25 percent of the supply in the London area and 60 percent in places along the south coast. The Bristol Channel and the estuaries of the Thames and Mersey Rivers are important sources of sand.

A new marine aggregate plant was commissioned in northeast England in 1969, at Gateshead in the Newcastle area. The plant will apparently process aggregate dredged from the Humber estuary, about 100 miles to the south. The operating company was Alan S. Denniff Ltd., a subsidiary of the Steetly Co. which operates marine aggregate plants at Southhampton and Newhaven on the south coast.

On the Thames estuary, a $2 million marine aggregate plant was under construction by Associated Fisheries Ltd. at Cliffe, Kent. Among other developments, Amey Marine Ltd. contracted to supply a Dutch firm with 500,000 tons of dredged gravel per year for 10 years.

Clays.—The United Kingdom remained the world's leading exporter of clay in 1969. Exports increased about 13 percent compared with 1968, to 2.6 million tons valued at $62 million. China clay was the principal commodity, accounting for 80 to 85 percent of domestic output and exports; it was also the most valuable crude material commodity exported by the United Kingdom and accounted for 70 percent of the value of all exports of nonmetallic minerals.

Exports of china clay increased for the eighth consecutive year; 2.13 million tons was shipped in 1969 compared with 1.12 million tons in 1962. Exports to Common Market countries accounted for 53 percent of the total. Compared with 1968, the largest increases went to West Germany, Finland, and Canada, while shipments to the United States declined by 18 percent. Exports of ball clay in 1969 (415,000 tons) were 14 percent more than in 1968, while exports of other clays (57,000 tons) were essentially unchanged. An important part of the increasing demand for British clay in domestic and foreign markets came from papermaking industries.

Total output of clay (not including fireclay or clay shale) in 1969 was estimated at 3.7 million tons, almost all of which was mined open-cast in Cornwall and Devon. Increasing mechanization of quarries and processing operations has raised overall productivity by nearly 40 percent since 1965. English China Clays Ltd., which accounted for about 90 percent of total output, was investing $24 million in expansion of productive capacity.

Fluorspar.—Discovery of a promising deposit of fluorspar in Derbyshire was announced by Deepwood Mining Co. in late 1969. The deposit, located 6 miles northwest of Bakewell, was reported to contain over 50 percent CaF_2 and to be minable by open pit. Reserves were not specified. The company currently produces about 20,000 tons of fluorspar annually from four deposits in the vicinity.

A mill for production of up to 80,000 tons of acid-grade fluorspar annually was being built by C. E. Giulini (Derbyshire) Ltd. at the former Hopton works of Magnesium Elektron Ltd. Feed for the mill will come from dumps and tailings of old

[3] Organization for Economic Cooperation and Development (OECD). Draft Statistical Report on the Cement Industry in 1969 (Annexes). Paris, June 22, 1970, document DIE/I/CI/70.14.

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lead mining properties, supplemented by other materials for which contracts have been negotiated. Byproducts of the operation will include barite and concentrates of lead and zinc. Initial production was expected in 1970. The mill is the largest concentrating plant for acid-grade fluorspar to be built since 1965, when the Cavendish mill in Stoney Middleton was completed by Laporte Industries Ltd.

The Laporte Company's Glebe mine in Derbyshire was probably the largest single producer of fluorspar in 1969. Planned output for the year included approximately 94,000 tons of acid-grade fluorspar and 36,000 tons of metallurgical-grade fluorspar, plus 10,000 tons of barite and 3,800 tons of lead concentrates. The company continued development of the Sallet Hole mine, which is planned to replace Glebe as the major producer.

In Durham, annual production of fluorspar at the Blackdene mine will be increased from 7,500 tons to 20,000 tons when a new haulage level is completed. The mine is operated by United Steel Companies Ltd., a member of the BSC group. The new Redburn mine, operated by Weardale Lead Co., Ltd. (subsidiary of ICI), was producing fluorspar at the rate of 25,000 to 30,000 tons annually, including acid and metallurgical grades.

Gypsum and Anhydrite.—A record production of gypsum was achieved in 1969, while output of anhydrite declined to the level of 1966. A further decline in anhydrite production was expected by 1972, as ICI planned to close three anhydrite-based sulfuric acid plants at the Billingham works in Durham. The plants will be replaced by a single facility using sulfur instead of anhydrite for the production of acid.

Consumption of anhydrite for production of sulfuric acid in 1969 totaled 1,229,000 tons (1,278,000 tons in 1968), most of which was accounted for by ICI at Billingham and by Albright and Wilson, Ltd. at Whitehaven, Cumberland. Both companies produce anhydrite from underground mines near their plant sites, with annual outputs of about 1 million tons at Billingham and 650,000 tons at Sanwith (near Whitehaven). Anhydrite was also produced by British Gypsum, Ltd. in Cumberland and Westmorland.

Eight underground mines operated by British Gypsum Ltd. accounted for most production of gypsum in the United Kingdom. The location and approximate annual production of each were as follow:

Mine	County	Production (metric tons)
New Stamphill	Westmorland	500,000
Newbiggin	Cumberland	[1] 700,000
Sherburn No. 2	Yorkshire	100,000
Glebe	Nottinghamshire	300,000
Marblaegis	do	550,000
Fauld	Staffordshire	500,000
Montfield	Sussex	250,000
Brightling	do	450,000
Total		3,350,000

[1] Includes production of anhydrite.

Source: Metcalfe, J. E. British Mining Fields. Institution of Mining and Metallurgy, London, 1969, pp. 75–78.

In addition to those listed, the same company operated the Long Meg underground mine in Cumberland, producing about 350,000 tons of anhydrite per year, and an open pit mine in Nottinghamshire, producing gypsum.

Potash.—Plans to develop three potash mines near the Yorkshire coast were continued in 1969. Construction of one mine was started in April, but final decisions for construction of the others had apparently not been made by yearend.

At Boulby, near Staithes, Cleveland Potash Ltd. began construction on April 16. Two circular shafts, 18 feet in diameter, will be sunk to depths of 3,650 and 3,716 feet. The refinery, with a proposed output of at least 1 million tons of product annually, will be engineered by Head Wrightson Ltd. The mine and plant were expected to be in production in early 1973. Cleveland Potash Ltd. is jointly owned by ICI and Charter Consolidated Ltd.

Near Whitby, 15 miles southeast of Boulby, Yorkshire Potash Ltd. and Whitby Potash Ltd. planned to build mines at Hawkser and Egton Moor, respectively. Although Government permission to go ahead with both projects (located within North York Moors National Park) was expected early in 1970, firm decisions were being delayed by the companies pending results of further research. The Yorkshire company, a subsidiary of RTZ, planned an output of about 1 million tons of product, using dry-mining methods. The Whitby Company, owned by Armour & Co. and the Shell Group, planned to produce 450,000 tons of potash products annually, using solution-mining techniques. A by-

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product of the latter operation would be 500,000 tons of sodium chloride annually, which might be marketed as road salt or disposed of in the sea.

Imports of potassium salts in 1969 included 704,000 tons of chloride and 41,000 tons of sulfate. East Germany continued to be the major supplier, accounting for 27.5 percent of the total, followed by France (16 percent), West Germany (13 percent), and Canada (12 percent). Other important suppliers were the United States, the U.S.S.R., and Spain.

Despite the domestic production of potash planned from Yorkshire, the British distributor of East German potash, Propane Fertilisers Ltd., renewed its sales contract with the East German firm of Bergbau-Handel G.m.b.H. for another 10 years. The contract involves about 4 million tons of potash and magnesium salts (including kainite and kieserite) over the 10-year period.

Sulfur.—Britain continued to rely on imports for 80 percent of sulfur supplies. Imports of elemental sulfur dropped slightly in 1969, to 743,000 tons valued at $31 million. France was the major supplier with 236,000 tons; imports from the United States and Poland increased sharply, to 173,000 tons and 164,000 tons, respectively, while shipments from Mexico dropped off to 129,000 tons. Imports of pyrite were virtually unchanged from the 1968 level, with Cyprus remaining the principal source.

Output of sulfuric acid declined slightly to 3,286,000 tons in 1969. Use of elemental sulfur for this purpose continued to rise slowly. Acid production in 1969 was based 58.2 percent on sulfur, 20.3 percent on anhydrite, 8.7 percent on pyrite, 8.0 percent on smelter gas, 3.6 percent on spent oxide, and 1.2 percent on byproducts of coking plants, oil refineries, and steel-processing plants. Output from anhydrite, the principal domestic sulfur resource, was centered at Billingham and Whitehaven in north England.

Construction of two major sulfur-based acid plants was underway in 1969. At St. Helens (Lancashire) a plant with annual output capacity of 200,000 tons of sulfuric acid was nearly completed for Leather's Chemical Co. Ltd. At Billingham (Durham), ICI was building a 300,000-ton-per-year plant, scheduled to come on stream in 1972. The latter plant, expected to be the largest in the United Kingdom, will replace three anhydrite-based plants now operated at the company's Billingham works. In other developments, Courtaulds Ltd. commissioned a 66,000-ton-per-year sulfur-based plant at Carrickfergus, Northern Ireland, and liquid sulfur dioxide plant (production capacity 15,000 tons per year) was brought on stream by Albright and Wilson, Ltd., at Bromborough, Cheshire.

Total output capacity for sulfuric acid in 1969 was approximately 4.2 million tons annually, of which more than 75 percent was owned by seven companies or company groups, as follows:

Company	Annual output capacity (thousand tons)	Percent of United Kingdom capacity
ICI Group	900	21.4
Imperial Smelting Corp. Ltd	470	11.2
Laporte Industries Ltd.	440	10.5
Albright and Wilson Ltd	420	10.0
Fisons Group	390	9.3
British Titan Products Ltd	350	8.3
Courtaulds Ltd	320	7.6
Total	3,290	78.3

Source: British Sulphur Corp. Ltd. (London). Sulphur. No. 86, January–February 1970.

A sulfur recovery unit was being built at the South Killingholme petroleum refinery of Continental Oil Co. near Immingham. Output capacity was approximately 17,000 tons of sulfur annually. A small output of sulfur (less than 1,000 tons annually) was also expected to begin in mid-1970 from processing of natural gas by Home Oil of Canada, Ltd.

MINERAL FUELS

Total consumption of energy in the United Kingdom went up again in 1969, to a total of 322.7 million metric tons of standard coal equivalent, about 3.4 percent more than in 1968. However, the share of coal (slightly over 50 percent of the total in 1969) continued to decline. Virtually all of the expansion in the United Kingdom's consumption of primary energy was due to oil and natural gas. The following tabulation shows the share of different fuels in the total energy consumption:

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Fuel	Percent	
	1968	1969
Coal (all kinds)	53.6	50.8
Oil	41.0	42.7
Natural gas	1.4	2.5
Hydroelectric power	.7	.7
Nuclear power	3.3	3.3
Total	100.0	100.0

Source: Petroleum Press Service (London), June 1970.

Natural gas was the focal point of developments in the energy industry of the United Kingdom. Development of offshore gasfields in the North Sea, completion of the land terminal at Bacton, and important extensions to the national gas pipeline grid were the principal events. The share of imported liquefied natural gas in the total supply was increased.

The United Kingdom remained almost totally dependent on imports for its supply of crude oil. Imports of crude oil totaled 94.6 million tons, a 14-percent increase over 1968 imports. Expansion of the refinery at Killingholme, operated by Lindsey Oil Refinery Ltd., and of plants at other locations brought total refinery capacity to 106 million metric tons annually at the end of 1969. Further growth of the petroleum refining industry was indicated, and it was possible that discoveries of crude oil offhsore in the North Sea could significantly increase domestic supplies.

A small rise in coal consumption resulted from larger demand for coal for power generation. However, contraction of the coal industry continued during 1969. Production declined by about 14 million tons, and 55 mines were closed. The continued decline of coal production was in accord with the Government's estimate of the declining role of coal in the country's energy industry. The National Coal Board (NCB) was making every effort to improve the competitiveness of coal. The NCB planned to accomplish this through closure of mines, improved use of equipment, and concentration of production.

Coal.—The decline in production of coal is illustrated by the following tabulation, which shows output by NCB areas during the last 2 fiscal years (ending March 31 of the latest year indicated):

	Million metric tons[1]	
	1968–69	1967–68
Scottish North	5.2	5.6
Scottish South	7.6	8.5
Northumberland	8.1	8.9
North Durham	6.6	7.9
South Durham	8.9	10.2
North Yorkshire	9.8	10.2
Doncaster	9.7	9.7
Barnsley	9.4	10.1
South Yorkshire	11.8	11.8
North Western	8.0	10.0
North Derbyshire	11.7	12.9
North Nottinghamshire	11.9	11.3
South Nottinghamshire	11.3	12.5
South Midlands	10.0	11.1
Staffordshire	9.2	10.2
East Wales	9.1	10.1
West Wales	5.7	6.2
Kent	1.5	1.5
Subtotal	155.5	168.7
Opencast (strip)	6.4	7.0
Licensed mines	1.0	1.1
Total salable	162.9	176.8

[1] Converted from long tons by using factor 1.01605.

Source: National Coal Board, Report and Accounts for 1968–69 (V. II, tables 2 and 8).

There were 317 coal mines producing at the end of March, compared with 376 a year earlier. Total employment fell from 392,000 to 336,000. Overall productivity averaged 2.220 metric tons per man-shift, compared with 1.981 metric tons in 1968. Despite the mine closures and sharp cutbacks in personnel, major labor disputes were avoided, mostly because the NCB maintained close cooperation and good industrial relations with the unions.

Total coal disposal including exports in 1968–69 rose for the first time in 5 years and totaled about 171 million metric tons. Electric powerplants remained the largest consuming sector, accounting for 44 percent of coal consumption. The following tabulation shows the inland consumption and exports of coal in the United Kingdom:

	Million metric tons	
	1968–69	1967–68
Power stations	75.7	70.3
Gasworks	9.3	13.8
Coke production	25.4	23.5
Industrial consumers	20.1	20.4
Domestic consumers	19.9	21.0
Miners and colliery issues	5.5	6.4
Railways	.2	.6
Other	11.8	12.3
Total inland	167.9	168.3
Exports	3.1	2.1
Grand total	171.0	170.4

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To keep coal competitive with other fuels, efforts continued to improve the efficiency of collieries and introduce more mechanization. It was expected that by 1970 all deep-mined coal will be produced by mechanical methods. During fiscal 1968–69, 1,154 power-loading machines were in use, and about 92 percent of the total deep-mined production was won by loading machines, with approximately 74 percent coming from faces with powered supports. Efforts were continued to concentrate production at mines having large reserves as well as the best potential for improvement of productivity. Of the 317 operating mines, 27 produced over 1 million metric tons of coal during the year. To insure higher returns on investment and to avoid costly effects of lost production, mining operations were concentrating on fewer and highly capitalized faces.

Improvement of mining methods, and especially of mine transportation systems, was needed to realize the advantages gained by increased output at the face. Inadequate transport was the principal cause of delays. Consequently, intensive studies of mine transport systems were underway, and two computerized evaluation systems —Simbelt, for conveyor belt operations, and Simloc, for locomotive operations— were being used to study these problems.

One of the more significant investments in this program was underway at the Lee Hall colliery at Rugeley. This was the first completely new mine developed by the NCB and is based on new reserves located in the Cannock Chase coalfield. During 1969 the mine reached a production rate of 1.5 million tons annually, and output was scheduled to increase to 2 million tons in 1973. In 1969 a new coal preparation plant was completed, for ash control of small coal delivered to the nearby power station, and new reserves were developed. To attain the 2-million-ton production, a 42-inch conveyor will be built to move coal to the shaft, but the existing winding capacity and two 24-foot-diameter shafts are adequate to handle the increased output.

Gas.—During 1969 domestic gas plants, mine gas, natural gas (mostly offshore), and imported liquefied natural gas were the principal sources of gas in the United Kingdom. The aggregate quantity of gas available during the fiscal year 1968–69 (ending March 31,1969) was 5,165 million therms (1 therm equals 100,000 British thermal units) or about 11 percent more than in the previous year. The following tabulation shows the sources of gas available in the United Kingdom for fiscal years ending in 1968 and 1969:

	Million therms	
	1967–68	1968–69
Gas (manufactured):		
Coal gas	977	665
Oil gas	1,660	2,134
Water gas and other gases	228	143
Gas (purchased):		
Refinery gas	328	285
Liquefied petroleum gas	410	346
Coke oven gas	395	358
Other (including natural gas used in gas manufacture)	627	1,074
Subtotal	4,625	5,005
Natural gas direct to consumers	13	160
Total gas available	4,638	5,165

About 63 percent of gas was sold to domestic consumers, 21 percent to industrial plants, and 14 percent for commercial uses; 2 percent was lost or unaccounted for.

Manufactured Gas.—The maximum daily production capacity of manufactured gas was 6,798 million cubic meters (33.5 million therms). In accordance with the industry's policy of rationalization, the number of gas plants in operation was reduced from 192 to 170 during 1969. For production of manufactured gas 9.3 million tons of coal and 5.9 million tons of oil were consumed.

Natural Gas.—The total amount of natural gas supplied to area boards amounted to 1,284.8 million therms, of which 160 million therms, or 12.4 percent, was delivered directly to consumers. The number of customers converted from manufactured gas to natural gas increased from 3,000 to 12,500 per week. By March 1969 a total of about 496,000 customers had switched to the use of natural gas. Existing plans call for 1.5 million such conversions by March

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1970. It was obvious that natural gas was becoming important in the overall gas supply of the United Kingdom.

Exploration in the North Sea continued during 1969. No significant discoveries were made, although 69 wells were drilled. More important extensions of known structures were announced in the following blocks: 49/17 (Continental Oil-NCB), 43/20 (Hamilton Bros.), and 49/25 (Shell-Esso). Total Marine Ltd. announced a gas discovery about 6 miles off Scarborough. Eight wells were dry, of which two were drilled in block 110/8 of the Irish Sea, three in Norfolk county, and one each offshore in Yorkshire, Lincoln, and Merioneth. Additionally, a probable three-well program off Lancashire was begun during 1969. The operation was a joint venture of Gulf Oil Corp. and NCB using their offshore rig "Gulftide."

Development of five proven gasfields—West Sole British Petroleum Co. Ltd. (BP), Leman (Shell-Esso and Amoco), Hewett (Phillips and Atlantic Richfield North), Indefatigable (Shell-Esso and Amoco), and Viking (Continental Oil Co. and NCB)—continued during 1969. Other operations included drilling of 24 directional wells at Leman field, seven at Viking, and three at Sole field, and construction of permanent production platforms, submarine pipelines, and onshore gas terminals. In mid-1969 the second phase of the large gas terminal at Bacton was completed. The terminal now can handle 4,000 million cubic feet of gas per day. Gas from the Hewett and Leman fields started to flow through Bacton facilities.

Total recoverable reserves of natural gas were judged sufficient to sustain an average flow of 3,000 million cubic feet per day for 20 to 30 years. It should be noted that other gas finds have been announced but were not yet fully evaluated.

With the new gas facilities available, storage of sufficient gas to cover peak demand was important; therefore, studies to determine the most economical storage facilities were continued during 1969. Three principal methods were studied; namely, underground storage in aquifers, high-pressure storage in natural or artificial cavities, and storage of liquefied gas in above- or below-ground chambers. All of the studies were in preliminary stages; however, aquifer studies showed the Cousland and Sardsen structures were not satisfactory storage sites and work on them has been suspended for the time being. At Canvey, four refrigerated above-ground storage units for liquefied natural gas, each of 21,000 tons capacity, were commissioned. At the same time the Gas Council has decided to construct a plant for liquefaction and storage of natural gas on a site at Glenmavis, about 10 miles east of Glasgow. Technical and economic studies were being made to determine the size of the facility.

During fiscal 1968–69, the Board completed 880 miles of trunk pipelines and an additional, 2,420 miles of local pipelines. Projects of special interest included the completion of a 42-inch diameter pipeline between Portsmouth and Southampton, and the completion of the orbital pipeline extending from Romford on the east side of London to Slough on the west side of the city.

Nuclear Energy and Uranium.—Reconnaissance surveys for deposits of uranium in northern Scotland were nearly completed in 1969. Although no quantitative information was available, concentrations of uranium (classified only as occurrences, until substantiated by drilling) were reported at three localities in Caithness: near Helmsdale, Houstry of Dunn, and in the Brawlbin-Broubster district. Uranium occurrences had been previously reported in this area, in the Helmsdale granite and in shaly beds of the Old Red sandstone. Elsewhere, surveys were continuing in south Scotland, the Midlands, and southwest England. Investigations were being conducted by the Institute of Geological Sciences on behalf of the Atomic Energy Authority, under a 5-year, $600,000 program started in 1968.

The United Kingdom remained the world's leading producer of nuclear power in 1969. The country's 14 powerplants produced 28.5 billion kilowatt-hours in calendar

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1969, approximately 12 percent of all electricity generated. The Wylfa powerplant, last and largest of the First Program plants (based on the magnox type of reactor), was completed in 1969. Five plants of the Second Program type (based on the advance gas-cooled reactor) were under construction. Nuclear powerplants operating and under construction in the United Kingdom in 1969 are shown in the following tabulation:

Plant	Electrical megawatts (Mwe) (gross output)	Entry in service
Operating:		
Calder Hall	150	1956
Chapelcross	150	1958
Dounreay 1	15	1959
Berkeley	275	1962
Bradwell	300	1962
Windscale	34	1962
Hunterston "A"	360	1964
Hinkley Point "A"	500	1965
Dungeness "A"	550	1965
Trawsfynydd	500	1965
Sizewell	580	1966
Oldbury	600	1967–68
Winfreth	100	1967
Wylfa	1,180	1969
Total operating	5,294	
Under construction:		
Dungeness "B"	1,320	1970–71
Dounreay 2	250	1971
Hinkley Point "B"	1,320	1972–73
Hartlepool	1,320	1973–74
Hunterston "B"	1,250	1973–74
Total under construction	5,460	

Principal sources: (1) Organization for Economic Cooperation and Development (OECD) (Paris). 21st Survey of Electric Power Equipment. 1968. (2) Petroleum Press Service (London). November 1967.

Petroleum.—During 1969 the United Kingdom remained an important processor of crude oil and a significant consumer of petroleum refinery products. As the domestic production of oil was minimal, imports were essential for the operation of the country's 22 refineries which had an annual capacity of 106 million metric tons at yearend 1969. Value of crude oil imports in 1969 amounted to US $1,610 million. Principal suppliers were Kuwait (25.4 percent), Libya (22.6 percent), Saudi Arabia (13.5 percent), Iran (8.5 percent), Venezuela (6.0 percent), and Nigeria (5.5 percent). In addition, the United Kingdom had a significant foreign trade in petroleum refinery products, valued at US $828.3 million.

There was practically no drilling for oil in the British Isles in 1969. Two wells were drilled near Norfolk, but results were not reported at yearend. Offshore drilling for oil in block 22–18, 180 miles east of Aberdeen (Scotland), yielded some indications of crude oil; however, after 9 months of drilling and tests, the Gas Council and Amoco partnership decided to stop the operation.

The United Kingdom's crude oil production in 1969 declined by about 5 percent compared with output in 1968. Production came from several small oilfields operated by BP. Output of these fields in 1968 and 1969 is shown by the following tabulation:

Name of field	Metric tons [1]	
	1968	1969
Egmanton	16,436	14,572
Bothamsall	22,959	18,186
Plungar	857	1,124
Gainsborough	19,652	25,609
Kimmeridge	16,942	17,239
Other	4,505	510
Total	81,351	77,240

[1] Converted from long tons by using factor 1.01605.

United Kingdom refining capacity increased in 1969 by some 8.9 percent compared with 1968. Of the total of 22 refineries and 106 million tons capacity, four American companies (Esso, Texaco, Mobil, and Gulf) operated five refineries representing 37.4 percent, or 39.9 million metric tons, of refining capacity. In addition, Phillips Petroleum Co. and Imperial Petroleum Ltd. jointly operated a 5-million-ton-per-year refinery at Billingham.

Refineries operating in the United Kingdom at yearend 1969 were as follows:

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Company	Refinery location	Annual capacity on Dec. 31 1969 (thousand metric tons)
Esso Petroleum Co. Ltd	Fawley	16,500
	Milford Haven	6,300
Shell U.K. Ltd	Stanlow	10,750
	Shell Haven	10,000
	Teesport	6,000
	Heysham	1,950
	Ardrossan	200
BP Refinery (Kent) Ltd	Isle of Grain	10,000
BP Refinery (Llandarcy) Ltd	Llandarcy	8,000
BP Refinery (Grangemouth) Ltd	Grangemouth	4,500
BP Refinery (N. Ireland) Ltd	Belfast	1,500
Mobil Oil Corp. Ltd	Coryton	7,000
Lindsey Oil Refinery Ltd	Killingholme	7,000
Texaco Refining Co. Ltd	Pembroke	5,900
Phillips-Imperial Petroleum Ltd	Billingham	5,000
Gulf Oil Refining Ltd	Milford Haven	4,000
Philmac Oils Ltd	Eastham	400
Berry Wiggins & Co. Ltd	Kingsnorth	285
	Weaste	170
Burmah Oil Trading Ltd	Ellesmere Port	250
	Barton	175
William Briggs & Sons Ltd	Dundee	85
Total		105,965

Refinery throughput in 1969 amounted to 91.6 million metric tons, or about 10.3 percent more than in 1968. Refinery output was estimated at 93.5 percent of capacity. Diesel and fuel oils constituted about 63 percent of total refinery output, followed by gasoline with 11 percent.

Consumption of petroleum refinery products continued to increase. Total inland consumption was 90.8 million metric tons in 1969, or 7.9 percent more than in 1968. Gasoline, gas oil, diesel oil, and fuel oils constituted the largest part of the total. Roughly 49 percent was taken up by gas oil, diesel oil (other than transportation), and fuel oil. Gasolines, jet fuels, and diesel oil for transport vehicles accounted for another 18 percent of total consumption. Industry, power generation, nonindustrial heating, and transportation were the largest consuming sectors. The following tabulation shows consumption of petroleum refinery products in the United Kingdom for 1968 and 1969:

Product	Metric tons	
	1968	1969
Refinery gases	545,176	465,544
Propane	372,106	421,791
Butane	814,064	786,719
Naphtha/L.D.F	10,246,866	11,250,780
Aviation spirit	104,510	100,869
Aviation turbine fuel, wide cut	347,219	281,952
Aviation turbine fuel, other	2,764,474	2,968,121
Motor spirit (including motor benzole)	13,013,082	13,443,841
Industrial spirits (including industrial benzole)	219,854	100,870
White spirit	147,080	144,196
Burning oil	1,998,786	2,243,903
Vaporizing oil	75,418	64,525
Derv fuel	4,650,649	4,868,100
Gas/diesel oil	9,169,888	10,514,569
Fuel oil, light	3,430,141	3,451,437
Fuel oil, medium	5,201,210	5,520,585
Fuel oil, heavy	22,471,141	24,956,580
Lubricating oils and greases	1,151,742	1,227,524
Paraffin wax and scale	55,504	59,185
Bitumen	1,857,716	1,840,816
Chemical feedstock (other than naphtha)	356,850	411,467
Refinery consumption, fuel oil	5,164,508	5,653,532
Total deliveries into inland consumption	84,157,984	90,776,906
Bunkers, gas/diesel oil	730,688	780,196
Bunkers, fuel oil	4,612,864	4,805,222
Total bunkers	5,343,552	5,585,418
Methane	775,207	813,588

Source: Institute of Petroleum (London). Consumption and Refinery Production 1968 and 1969. May 1970, p. 3. (Figures converted from long tons, using factor of LT × 1.01605.)

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The principal events in the refining industry in 1969 included construction of a new refinery at Killingholme and expansion of existing capacity at Killingholme, Grangemouth (Scotland), and Ellesmere Port. The new Killingholme refinery, owned by Continental Oil Co. (United Kingdom) Ltd., will have a processing capacity of 4.5 million tons annually when completed in 1970; it will also be the only refinery in the country having facilities for production of petroleum coke (250,000 tons annually). Capacity of the old Killingholme refinery, operated by Lindsey Oil Refinery Ltd., was raised to 7 million tons annually, twice the former capacity. At Grangemouth, BP was expanding refining capacity by 55 percent, to 7 million tons annually. At Ellesmere Port, Burmah Oil Trading Ltd. was raising refining capacity to 1.5 million tons annually. Additional new refining projects announced during 1969 were as follows:

Company	Plant	Completion	Annual capacity (thousand metric tons)
Amoco (U.K.) Ltd	Milford Haven	End 1973	4,000
Occidental Petroleum Corp	Canvey Island	End 1973	5,000
Grampian Chemicals Ltd	Invergordon, Scotland	Indefinite	7,000
Murco Petroleum Ltd	Clydeside	----do	2,500
Chevron Oil (U.K.) Ltd	Portencross, Scotland	----do	5,000
Total			23,500

The United Kingdom remained a net importer of refinery products. In 1969 the trade deficit attributable to petroleum products was valued at US $182.4 million, an improvement compared with the 1968 figure of US $271.0 million.

Principal customers for refined products in 1969 included Sweden, Denmark, the Irish Republic, Norway, and West Germany. Trade in refined products with the United States during 1969 was relatively insignificant.

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The Mineral Industry of Venezuela

By Gordon W. Koelling [1]

The value of Venezuela's crude mineral production rose only 0.1 percent during 1969 as sizable increases in the output of iron ore and several other minerals were almost counterbalanced by a slight decline in crude oil production. Approximately 94 percent of the value of crude mineral production was accounted for by the petroleum (including natural gas) industry which also provided 64 percent of the Government's ordinary revenues and was responsible for over 90 percent of the country's total export receipts.

Despite a small decline in crude oil output, Venezuela remained the world's leading petroleum exporting country and retained third place among the world's crude oil-producing nations behind the United States and the U.S.S.R. This drop in production reflected some of the basic problems facing the Venezuelan petroleum industry. Costs of production remained high in comparison with those in other major petroleum exporting countries, and crude oil reserves declined for the fourth consecutive year. Antipollution regulations severely limiting the allowable sulfur content of fuels used in the Eastern United States continued to restrict the export of Venezuelan residual fuel oil to its principal market. Two desulfurization plants, one completed in 1969 and another under construction, with a combined capacity of 225,000 barrels per day of 1 percent sulfur residual fuel oil, were expected to partially alleviate this problem.

Approximately 90 percent of the value of Venezuela's nonpetroleum, crude minerals output in 1969 was accounted for by iron ore.

During February 1969, the Government issued Decree No. 1316 in connection with its policy to advance the economic use of natural gas produced at oilfields. This Decree states, among other things, that all natural gas being flared by private oil companies should be at the disposition of the nation.

[1] Geographer, Bureau of Mines, Washington, D.C.

PRODUCTION

The performance of the various sectors of Venezuela's mineral industry during 1969 was mixed. Production of aluminum and iron ore registered large gains but the output of other metals declined slightly. The output of most nonmetals was down with only diamonds and salt showing increases. In the case of mineral fuels and related materials, the production of coal, natural gas, and natural gas liquids advanced moderately while carbon black, crude oil, and refinery output registered relatively minor decreases.

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Table 1.—Venezuela: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969 [p]
METALS			
Aluminum, metal	3,090	10,000	13,804
Gold, metal, troy ounces	20,000	20,600	19,385
Iron and steel:			
Iron ore and concentrate, thousand tons	17,005	16,190	19,724
Pig iron, do	422	r 539	520
Steel ingots and castings, do	r 690	r 861	821
Steel semimanufactures, do	r 1,023	r 1,368	1,320
NONMETALS			
Cement, hydraulic, do	2,248	2,438	2,080
Diamond:			
Gem, carats	38,218	59,655	117,614
Industrial, do	31,409	54,345	76,169
Total, do	69,627	114,000	193,783
Fertilizer materials:			
Crude (natural); phosphate rock [e]	30,000	60,000	60,000
Manufactured; nitrogenous, gross weight [2]	135,245	r 151,092	147,154
Gypsum [e]	91,000	99,000	82,000
Salt, all types	r 171,000	126,000	171,000
Stone, limestone [e], thousand tons	2,890	3,170	2,700
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	7,350	7,350	7,258
Coal, bituminous	34,458	30,825	32,484
Gas, natural:			
Gross production, million cubic feet	r 1,615,992	r 1,634,602	1,672,989
Marketed, do	r 292,651	r 301,197	314,086
Natural gas liquids:			
Condensate, thousand 42-gallon barrels	1,896	1,987	1,999
Natural gasoline, do	3,334	3,183	3,048
Liquefied petroleum gases, do	7,462	7,397	8,773
Total, do	12,692	12,567	13,820
Petroleum:			
Crude, do	1,292,876	1,319,340	1,311,832
Refinery products: [3]			
Gasoline and naphthas, do	50,244	57,326	60,280
Kerosine, do	5,042	4,740	5,613
Jet fuel, do	26,183	24,791	23,773
Distillate fuel oil, do	67,642	67,006	55,250
Residual fuel oil, do	255,991	258,839	257,702
Lubricants, do	3,788	4,199	3,583
Asphalt and bitumen, refinery, do	5,477	5,476	4,816
Refinery gas [4], do	5,692	5,564	5,673
Other, do	4,872	5,496	5,377
Total, do	424,931	433,437	422,067

[e] Estimate. [p] Preliminary. [r] Revised.

[1] In addition to reported commodities, Venezuela is known to produce lime, sand, gravel, and clay, but data are not available on the output of these items.

[2] Sales.

[3] Includes refinery fuel.

[4] Liquid equivalent.

TRADE

Exports of mineral commodities continued to play a dominant role in Venezuela's overall foreign trade picture during 1967 and 1968, the latest years for which complete trade information is available. Petroleum accounted for approximately 95 percent of total mineral exports during these years. The United States was the principal destination of direct petroleum shipments, followed by the Netherlands Antilles. However, almost all of the petroleum exports to the latter area consisted of crude and unfinished oils destined for processing at two large refineries owned by the parent companies of Creole Petroleum Corp. and Cía. Shell de Venezuela, Ltd., Venezuela's first- and second-ranking crude oil producers. These refineries export their output and are, in a sense, an integral part of Venezuela's petroleum industry.

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Exports of Venezuelan petroleum from Venezuela and the Netherlands Antilles by principal areas of destination for 1967–69 were as follows:

Destination	Exports (thousand 42-gallon barrels)		
	1967	1968	1969
Western Hemisphere:			
Canada	142,541	155,357	161,631
Puerto Rico	56,279	63,618	75,418
Trinidad and Tobago	67,045	76,666	69,929
United States	507,032	505,091	512,673
Other	131,507	150,976	172,949
Total	904,404	951,708	992,600
Eastern Hemisphere:			
Western Europe:			
European Economic Community (EEC)	98,749	77,196	82,480
Spain	29,370	28,004	23,936
United Kingdom	80,003	81,243	69,253
Other	39,435	31,540	33,947
Subtotal	247,557	217,983	209,616
Other	46,612	43,823	35,275
Total	294,169	261,806	244,891
Grand total	1,198,573	1,213,514	1,237,491

Source: Ministerio de Minas e Hidrocarburos, Memoria y Cuenta, Año 1967, 1968, y 1969, Caracas, Venezuela, March 1968, March 1969, and March 1970.

The continued rise in exports of Venezuelan petroleum during 1969 despite a slight decline in crude oil production was accounted for by shipments from stocks.

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Table 2.—Venezuela: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum, metal, including alloys, all forms		301	615
Copper, metal, including alloys, all forms		1,681	570
Gold, metal, unworked or partly worked	troy ounces	19,290	NA
Iron and steel:			
Ore and concentrate	thousand tons	16,467	15,053
Metal:			
Pig iron, ferroalloys, and similar materials		79,971	60,950
Steel, primary forms		162,600	197,034
Semimanufactures		37,970	11,932
NONMETALS			
Cement		146,371	113,149
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s., kaolin (china clay)		25	------
Products, refractory, including nonclay brick		18	251
Gypsum and plasters		6,800	9,770
Salt		59,024	62,710
Stone, sand, and gravel:			
Dimension stone, crude and partly worked		495	529
Sand and gravel		82	(1)
MINERAL FUELS AND RELATED MATERIALS			
Carbon black		21	164
Coal and coke, including briquets		139	83
Gas hydrocarbons, natural gas liquids:			
Natural gasoline	thousand 42-gallon barrels	2,756	2,911
Liquefied petroleum gases	do	5,741	6,014
Petroleum:			
Crude and partly refined	do	886,635	898,499
Refinery products:			
Gasoline	do	22,639	28,810
Kerosine	do	692	278
Jet fuel	do	(2)	22,804
Distillate fuel oil	do	44,937	40,265
Residual fuel oil	do	239,294	233,749
Lubricants	do	2,685	2,928
Asphalt	do	3,210	2,896
Other	do	26,801	2,630

NA Not available.
[1] Less than $\frac{1}{2}$ unit.
[2] Included with other in 1967.

Source: Dirección General de Estadística y Censos Nacionales, Ministerio de Fomento, Boletín de Comercio Exterior, 1967 and 1968; Memoria y Cuenta, Año 1967 and 1968, Caracas, Venezuela.

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Table 3.—Venezuela: Principal destinations of selected mineral commodity exports, 1968

(Thousand metric tons unless otherwise specified)

Commodity	Quantity
METALS	
Iron and steel:	
Ore and concentrates, total	15,053
United States	10,470
Metal, total	270
Argentina	98
Mexico	64
Japan	60
NONMETALS	
Cement, total	113
Surinam	47
Brazil	31
MINERAL FUELS AND RELATED MATERIALS	
Gas hydrocarbons, natural gas liquids, total thousand 42-gallon barrels	8,925
Brazil do	2,602
Argentina do	1,973
United States do	1,652
Petroleum:	
Crude and partly refined, total do	898,499
Netherlands Antilles do	257,481
United States do	168,965
Canada do	102,307
Trinidad and Tobago do	75,522
Refinery products:	
Gasoline, total do	28,810
Puerto Rico do	13,505
United States do	4,807
United Kingdom do	4,469
Kerosine, total do	278
United Kingdom do	278
Jet fuel, total do	22,804
United States do	14,895
Distillate fuel oil, total do	40,265
Canada do	16,335
United States do	6,782
United Kingdom do	2,194
Residual fuel oil, total do	233,749
United States do	159,564
Lubricants, total do	2,928
United Kingdom do	1,425
Sweden do	600
Asphalt, total do	2,896
United States do	2,336
Other, total do	2,630
Brazil do	1,144
Argentina do	289
United Kingdom do	247

Table 4.—Venezuela: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Oxide (alumina) and hydroxide	465	25,898
Metal:		
Unwrought	2,694	311
Semimanufactures	10,065	8,556
Antimony, metal, including alloys, all forms	18	74
Arsenic, trioxide, and pentoxide	26	20
Chromite	2,223	4,934
Copper:		
Copper sulfate	23	64
Metal:		
Unwrought	235	430
Semimanufactures	7,083	7,444
Gold, metal, worked or partly worked troy ounces	4,919	9,356
Iron and steel, metal:		
Scrap	4,710	31,094
Pig iron, ferroalloys, and similar materials	3,646	8,472
Steel, primary forms, ingots	5,366	6,714
Semimanufactures:		
Bars, rods, sections	55,309	55,439
Universals, plates, and sheets:		
Medium plates and sheets, uncoated	223,345	226,420
Other coated plates and sheets	69,197	71,104

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Table 4.—Venezuela: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS—Continued			
Iron and steel—Continued			
Semimanufactures—Continued			
Universals, plates, and sheets—Continued			
Other		17,684	17,176
Hoop and strip		3,081	4,997
Rails and accessories		1,422	1,526
Wire		24,476	23,907
Tubes, pipes, and fittings		56,960	66,262
Other		811	1,357
Lead, metal, including alloys, all forms		5,255	5,087
Mercury	76-pound flasks	55	85
Nickel, metal, including alloys, all forms		68	246
Platinum-group metals, including alloys, all forms, platinum	troy ounces	86,839	52,020
Silver, metal, including alloys, all forms	do	161,814	193,612
Tin, metal, including alloys, all forms	long tons	328	223
Titanium oxide		4,105	4,629
Zinc, metal, including alloys:			
Unwrought		5,129	6,865
Semimanufactures		247	934
NONMETALS			
Abrasives, natural, n.e.s.		199	355
Asbestos		5,011	5,664
Barite		8,169	14,929
Boron materials, crude natural borates		1,461	1,270
Cement		515	1,569
Clays and clay products (including all refractory brick), crude clay, n.e.s.:			
Bentonite		4,406	8,414
Kaolin (china clay)		6,478	9,799
Other		11,035	16,132
Cryolite and chiolite		1,104	411
Diamond, industrial	thousand carats	20	2,115
Diatomite and other infusorial earths		2,931	2,871
Feldspar		8,319	9,801
Fertilizer materials, crude and manufactured:			
Nitrogenous		27,954	16,078
Phosphatic		10,752	2
Potassic		25,300	24,076
Mixed		365	353
Fluorspar		1,999	202
Graphite, natural		270	189
Gypsum and plasters		210	214
Magnesite		1,800	3,457
Mica, all forms		488	359
Salt		(1)	55
Sodium and potassium compounds		48,331	63,763
Stone, sand, and gravel:			
Dimension stone		3,462	2,690
Crushed rock		49,608	42,563
Sand and gravel		5,045	7,351
Sulfur [2]		26,891	42,961
Talc, steatite		3,437	5,804
Vermiculite		221	524
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		245	624
Carbon black		460	721
Coal, all grades, including briquets		4,463	18,202
Coke and semicoke		208,881	360,288
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	209	62
Kerosine	do	1	1
Lubricants	do	37	43
Mineral jelly and wax	do	2	11
Other	do	57	41

[1] Less than ½ unit.
[2] Mostly unrefined.

Source: Dirección General de Estadística y Censos Nacionales, Ministerio de Fomento, Boletin de Comercio Exterior, 1967 and 1968, Caracas, Venezuela.

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Table 5.—Venezuela: Principal sources of selected mineral commodity imports, 1968

(Thousand metric tons unless otherwise specified)

Commodity	Quantity
METALS	
Aluminum, metal:	
Oxide (alumina) and hydroxide, total	26
United States	26
Iron and steel, metal:	
Scrap, total	31
United States	27
Semimanufactures, total	468
Japan	174
West Germany	64
Belgium-Luxembourg	54
Platinum-group metals, including alloys, all forms, platinum, total thousand troy ounces	52
West Germany do	50
Silver, metal, including alloys, total do	194
United States do	117
NONMETALS	
Barite, total	15
Brazil	12
Fertilizer materials, crude and manufactured, total	41
United States	24
Spain	11
Sodium and potassium compounds, total	64
United States	55
Sulfur, total	43
Poland	31
MINERAL FUELS AND RELATED MATERIALS	
Coal, all grades, including briquets, total	18
United States	9
United Kingdom	9
Coke and semicoke, total	360
United States	164
Norway	133

COMMODITY REVIEW

METALS

Aluminum.—The capacity of Venezuela's only aluminum reduction plant was increased from 11,000 to 22,500 tons per year by the completion of an expansion project during 1969. This plant, located at Matanzas just outside of Puerto Ordaz, is operated by Aluminio del Caroni, S.A., a joint venture of Reynolds Metals Co. and Corporación Venezolana de Guayana (C.V.G.), a Venezuelan Government entity. Electric power is supplied to the plant from the hydroelectric facilities at Macagua Dam and the recently completed Guri Dam.

Gold.—Early in 1969, J. R. Mowat & Associates, Ltd., a Canadian consulting firm, completed an extensive 2 year exploration program in the El Callao area of the State of Bolívar under contract to the Ministerio de Minas e Hidrocarburos. The project resulted in the discovery of an additional 2 million tons of gold ore in the area which had been the site of large-scale gold mining before rising costs resulted in the decline of operations during the late 1940s and the cessation of all significant activity in the early 1950's.

Iron and Steel.—As a result of increased steel production in the United States and Western Europe and strikes which affected ore production in other parts of the world, Venezuela's iron ore production increased almost 22 percent during 1969. Almost all of the country's output was accounted for by the Orinoco Mining Co., a subsidiary of United States Steel Corp., which produced 80 percent of the total and Iron Mines Co. of Venezuela, a subsidiary of Bethlehem Steel Corp., which produced 18 percent. The remaining 2 percent consisted of ore produced in connection with test drilling and other evaluation activities at the San Isidro deposits near Ciudad Piar.

Approximately 95 percent of Venezuela's 1969 iron ore output was exported. Almost all domestic consumption was accounted for by Siderúrgica del Orinoco, S.A. (SIDOR), a subsidiary of C.V.G., which obtained the bulk of its ore supply from Orinoco Mining.

Construction at Orinoco Mining's 1-million-ton-per-year iron-ore briqueting plant at Puerto Ordaz was considerably delayed by labor problems during 1969. These problems had not been resolved at

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yearend, and completion of the plant was expected to be delayed until at least late in 1971. This plant will use a natural gas reduction process to upgrade ore to an average 86.5 percent iron content.

A study to determine the feasibility of exploiting the San Isidro iron-ore deposits was near completion at yearend 1969. This study was being carried out under contract to the Ministerio de Minas e Hidrocarburos by a consortium consisting of Philipp Brothers of the United States, Wells Overseas, Ltd., of Canada, and Schneider-Creusot of France.

Venezuela's output of pig iron, produced exclusively by SIDOR, declined almost 4 percent during 1969. Output of crude steel and semimanufactures, which declined 5 and 3 percent, respectively, was also accounted for primarily by SIDOR with small quantities being produced by Siderúrgica Venezolana, S.A. (SIVENSA), a private company. This small decrease in the production of iron and steel resulted almost entirely from a short strike against SIDOR early in September and a second strike against the same company, which lasted almost the entire month of December.

Work on the installation of two soaking pits and an oxygen unit at SIDOR's Ciudad Guayana steel mill was in progress at yearend 1969. Bidding on the supply, installation, and preliminary operation of the equipment for SIDOR's planned expansion into flat products and tin plate manufacture, were delayed by political difficulties, and at yearend a new deadline of May 1970 had been set for offers.

A contract was awarded during 1969 to Tippetts, Abbey, McCarthy, and Stratton for a study concerning the possibilities of improving the transportation of iron ore and steel products. Alternatives under consideration are (1) a railroad from Puerto Ordaz to the Caribbean port of Guanta; (2) further dredging of the Orinoco River to accommodate vessels of deeper draft; (3) loading facilities at the mouth of the Orinoco; and (4) an ore slurry pipeline to the coast. The dredging alternative is considered most likely to be adopted.

Nickel.—The Ministerio de Minas e Hidrocarburos and Société Le Nickel were unable to reach an agreement on a joint venture for the development of the nickel deposits at Loma de Hierro in the States of Aragua and Miranda, and preliminary arrangements with the French firm were terminated. Subsequently, the Ministerio invited 12 international companies, including Société Le Nickel and four U.S.-owned firms, to make preliminary offers. The U.S.-owned firms invited were Universal Nickel Corp., Whittaker Corp., National Bulk Carriers, and Occidental Corporation de Venezuela, a subsidiary of Occidental Petroleum Corp. Reserves in the Loma de Hierro deposit have been estimated at 38 million metric tons of dry ore with an average nickel content of approximately 1.5 percent.

NONMETALS

Asbestos.—During 1969, the Ministerio de Minas e Hidrocarburos was engaged in the final phase of its evaluation of the asbestos deposits at Tinaquillo in the State of Cojedes. The economically exploitable reserves contained in these deposits were calculated by the Ministeria at 1.5 million tons of fibre-bearing rock. An unidentified international company reportedly submitted a preliminary proposal at yearend for the development and exploitation of these deposits.

Fertilizer Materials.—Work continued during 1969 on the expansion of the chemical fertilizer facilities of the Instituto Venezolano de Petroquímica (I.V.P.), the national petrochemical company, at Morón. A new 600-ton-per-year ammonia plant, which will raise the ammonia output of the Morón complex to 200,000 tons per year, was nearing completion at yearend. As of the same date, the basic engineering studies for a planned 750-ton-per-year urea plant had been completed, and the basic engineering phase of the project for the production of phosphate fertilizers had almost been concluded.

Activities at the site of a planned petrochemicals complex at El Tablazo near Lake Maracaibo were limited primarily to civil works construction during 1969. However, by yearend, work had been initiated on the ammonia plant of Venezolana de Nitrógeno (NITROVEN), a joint venture owned 50 percent by I.V.P., 40 percent by International Development and Investment, a U.S. and European consortium, and 10 percent by Petroquímica Atlántico of Columbia. This plant, scheduled for completion during 1972, will have a capacity to

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produce 594,000 tons of ammonia and 792,000 tons of urea annually.

A project involving the construction of a 1,500-ton-per-day ammonia plant adjacent to the Bajo Grande natural gas processing plant was cancelled. The ammonia plant was to have been built by a consortium consisting of Venezuelan Sun Oil Co., I.V.P., Venezuelan Atlantic Refining Co., Texaco Maracaibo, Inc., and Texaco Seaboard, Inc.

MINERAL FUELS

Coal.—Coal output increased by more than 5 percent during 1969. All output was from the State of Táchira, and the principal producing company was C.A. Minas de Carbón de Lobatera, which accounted for 85 percent of the total.

During the last half of 1969, an agreement in principal was reached between the Ministerio de Minas e Hidrocarburos and a British consortium whereby the latter was to investigate the commercial possibilities of the Naricual mines and of the coal deposits in the Parijá district of the State of Zulia at its own cost. Should the results of these investigations prove favorable, the consortium apparently would have priority rights with respect to negotiations for an exploitation contract.

Petroleum and Natural Gas.—Venezuela's output of crude oil declined slightly to 3,594,061 barrels per day during 1969. Medium crudes (22.1° to 30° API) accounted for approximately 40 percent of total production, light crudes (over 30° API) 35 percent, and heavy crudes (under 22.1° API) 25 percent. Companies owned by U.S. firms produced about 73 percent of the total with Creole Petroleum Corp., a subsidiary of Standard Oil Co. (New Jersey), alone accounting for 43 percent.

Natural gas production, over 98 percent of which was from oilfields, rose 2 percent to 4,584 million cubic feet per day in 1969. This resulted primarily from a 36-cubic-foot-per-barrel increase in the average gas/oil ratio at producing oil wells to 1,275 cubic feet per barrel during the year. The output of natural gas liquids rose almost 10 percent to 38,000 barrels per day in conjunction with an increase in the capacity of the country's natural gas processing plants.

Table 6.—Venezuela: Salient statistics of the petroleum and natural gas industry

		1967	1968	1969
Crude oil:				
Production	thousand 42-gallon barrels	1,292,876	1,319,340	1,311,882
Processed at refineries	do.	425,532	434,032	421,783
Exports	do.	886,635	898,499	903,728
Natural gas:				
Production	million cubic feet	r 1,615,992	r 1,634,602	1,672,989
Sales	do.	r 119,328	r 125,331	130,734
Producers' fuel	do.	r 145,884	r 148,462	151,075
Shrinkage due to extraction of natural gas liquids	do.	r 27,439	27,404	32,277
Field injection	do.	r 700,640	r 738,179	752,835
Flared or otherwise lost	do.	r 622,701	r 595,226	606,068
Natural gas liquids:				
Production	thousand 42-gallon barrels	12,692	12,567	13,820
Exports	do.	8,497	8,925	7,771
Refinery products:				
Refinery output [1]	do.	424,931	433,437	422,067
Consumption	do.	r 46,967	r 50,508	51,468
International bunkers	do.	19,801	20,380	18,918
Exports	do.	340,258	334,360	341,209

r Revised.
[1] Includes refinery fuel.

Source: Ministerio de Minas e Hidrocarburos. Memoria y Cuenta, Año 1967, 1968, y 1969, Caracas, Venezuela, March 1968, March 1969, and March 1970.

Proved reserves of crude oil declined for the fourth consecutive year, dropping 779 million barrels to a reported total of 14,890 million barrels at yearend 1969. Natural gas reserves, on the other hand, increased 325 billion cubic feet to a total of 27,077 billion cubic feet as of the same date. Approximately 92 percent of total proved gas reserves was accounted for by dissolved and associated gas; only 8 percent was nonassociated.

Geologic and geophysical exploration and exploratory, development, and injection drilling activities were as follows:

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		1967	1968	1969
Geologic and geophysical exploration:				
Geologic surveying	party months	4.2	3.5	3.5
Gravimetric surveying	do	--------	0.5	0.7
Magnetic surveying	do	--------	0.5	0.7
Seismic surveying	do	5.6	9.2	12.9
Structural drilling	do	5.1	5.0	11.3
Total	do	14.9	18.7	29.1
Drilling:				
Wells drilled:				
Exploratory:				
Oil	number	44	74	69
Dry	do	31	26	33
Subtotal	do	75	100	102
Development:				
Oil	do	232	324	375
Dry	do	11	14	12
Subtotal	do	243	338	387
Injection	do	8	9	11
Total	do	326	447	500
Footage drilled	thousand feet	2,448	3,487	3,188

Source: Ministerio de Minas e Hidrocarburos. Memoria y Cuenta, Año 1967, 1968, y 1969, Caracas, Venezuela, March 1968, March 1969, and March 1970.

During the latter part of 1969, the Ministerio de Minas e Hidrocarburos initiated a program to examine the possibility of economic exploitation of the Orinoco tar belt. This belt extends through the southern portions of the States of Guárico, Anzoátegui, and Monagas, and occupies a part of the Federal District of Delta Amacuro. Estimates of the total crude oil in place within the tar belt vary from 200 to 700 billion barrels. Most tar belt crude is too heavy for production by normal means.

At midyear, the Government oil company, Corporación Venezolano del Petróleo (C.V.P.), awarded a contract to Geophysical Service, Inc., a U.S. company, for an offshore geophysical survey. This survey is to cover an area of 1,375,000 hectares on the Continental Shelf between the Orinoco delta and the Venezuela-Trinidad median line. Results of the survey were to be delivered to C.V.P. by July 1970.

Revised bids for service contract areas covering approximately 250,000 hectares in the southern part of Lake Maracaibo were submitted to C.V.P. in July 1969. As of that date, C.V.P. had offers from 11 companies or groups of companies involving a total of 16 firms, 10 of which were U.S.-owned. At yearend, the Government was preparing to request the Venezuelan Congress for approval of the contract bases (minimum conditions) established by C.V.P. This approval is necessary before C.V.P. can conclude individual service contracts with private oil companies.

The capacity of gas injection facilities was increased by 222 million cubic feet daily to a total of 3,620 million cubic feet per day in 1969. Gas injection during the year was at an average rate of 2,111 cubic feet daily. Water injection capacity was raised 166,000 barrels per day to a total of 1,480,000 barrels daily by yearend 1969, and the average injection rate during the year was 1,046,000 barrels per day.

Refinery output averaged 1,156,000 barrels per day during 1969, down almost 3 percent from the previous year. This decline resulted from a sharp drop in the output of the Venezuelan Gulf Refining Co. plant at Puerto La Cruz after it was seriously damaged by an explosion and fire in March 1969. Effective throughput capacity of this refinery was reduced from a normal 159,000 barrels per day to approximately 100,000 barrels per day during the remainder of the year, but repairs were expected to be completed by mid-1970.

A desulfurization plant with a capacity of 55,000 barrels per day of residual fuel oil with a maximum sulfur content of 1 percent was placed on stream at the Cía. Shell de Venezuela Ltd., refinery at Cardón in December 1969. Construction continued on the desulfurization complex at the Creole Petroleum Corp. plant at Amuay. This facility, when completed, is to have a capacity of 170,000 barrels per day of 1-per-

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cent sulfur residual fuel oil. The first phase of the Amuay desulfurization complex was scheduled to go on stream in mid-1970. Both the Cardón and Amuay desulfurization facilities are of the hydrogen process type and will depend on natural gas from oilfields in the Lake Maracaibo area to provide feedstock for the necessary hydrogen.

Creole Petroleum Corp. signed a contract with the Fluor Construction Co. during the latter part of 1969 for the construction of a fifth atmospheric distillation unit at the Amuay refinery. Completion of this unit would increase the refinery's throughput capacity by more than 40 percent to 640,000 barrels per day. However, at yearend, this project had not received the necessary Government approval.

C.V.P. continued to seek the formation of a joint Government-private enterprise for the construction and operation of a 135,000-barrel-per-day refinery. This plant would be designed to process heavy crude oils which would be provided by C.V.P.

The total length of refined products and natural gas pipelines in service increased 29 and 261 kilometers, respectively, during 1969, but Ministerio de Minas e Hidrocarburos figures showed a 479-kilometer decrease in the length of crude oil lines in service as a result of the dismantlement of 58 kilometers of line and the revision of previously published totals to eliminate duplication and any field gathering lines which had erroneously been included. Data on the length of pipelines in operation at yearend 1969 were as follows:

Type of line	Total length (kilometers)
Crude oil:	
Trunk	8,359
Secondary	2,568
Subtotal	5,927
Refined products	512
Natural gas	2,536
Total	8,975

Source: Ministerio de Minas e Hidrocarburos. Memoria y Cuenta, Año 1969, Caracas, Venezuela, March 1970.

The longest pipeline completed during 1969 was the gasline constructed by Creole Petroleum Corp. from Ulé in the northeastern Lake Maracaibo area to the Amuay refinery. This 240-kilometer, 165-million-cubic-foot-per-day line will supply natural gas to the desulfurization facilities under construction at Amuay. A 106-kilometer gas pipeline with a capacity of 275 million cubic feet per day connecting a gas compression plant in the center of Lake Maracaibo with the El Tablazo petrochemicals complex and the La Paz-Cardón gas transmission line was built jointly by C.V.P. and Cía. Shell de Venezuela, Ltd. Approximately 87 kilometers of natural gas line was abandoned during 1969 by Venezuelan Atlantic Transmission Corp.

At yearend, a 230-kilometer natural gas pipeline was under construction from Anaco to Puerto Ordaz. This C.V.P. line, which is to supply gas to Orinoco Mining Co.'s iron-ore processing plant under construction at Puerto Ordaz, was scheduled for completion in mid-1970.

An agreement reached between the Philadelphia Gas Works of Philadelphia, Pa., and C.V.P. near the end of 1969 calls for a joint effort to determine the economic, financial, and operational requirements for the exportation of liquefied natural gas from Venezuela. Philadelphia Gas Works is to study the liquefied natural gas market possibilities in the U.S. east coast area, prepare preliminary engineering requirements for receiving and sales facilities, and develop related financial studies. The agreement also calls for Philadelphia Gas Works and C.V.P. to collaborate in the selection of processes and designs, both for the liquefaction plant and the necessary tankers. C.V.P. will be responsible for arrangements with respect to the required natural gas supply and is to prepare preliminary engineering studies for the facilities needed to transport the gas to the liquefaction plant which would be constructed at Puerto La Cruz.

Should C.V.P. decide that a liquefied natural gas exports program would be feasible, it plans to form a joint venture with foreign investors for development of the project. Press accounts indicate a probable volume of 500 million cubic feet per day for such an export program and a target date of 1974 or 1975.

Several petrochemical projects in addition to those summarized previously under "Fertilizer Materials" were completed or in the planning stage during 1969. Work was completed on both the dodecyl-benzene and phthalic anhydride plants in Valencia. The 15,000-ton-per-year dodecyl-benzene

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plant was built by Química Venoco, a company owned 55 percent by private Venezuelan investors and 15 percent each by Phillips Investment Corp; Inversiones Shell; and I.V.P. Oxidaciones Orgánica, owned by the Montana Group; Sherwin-Williams Co.. I.V.P erected the 3,000-ton-per-year phthalic anhydride plant

During the latter part of 1969, I.V.P. called for bids on the construction of a chloro-soda plant at El Tablazo which would have a capacity to produce 35,000 tons of chlorine and 39,200 tons of caustic soda annually Some details were still being negotiated at yearend with respect to a 50,000-ton-per-year, low-density polyethylene plant planned for the El Tablazo petrochemicals complex. This plant is to be built by Unicar Petroquímica, C.A.. which is owned 60 percent by Union Carbide Corp. and 40 percent by I.V.P. Also under consideration for construction at El Tablazo were an I.V.P.-B.F. Goodrich Co. project for the production of 50,000 tons of vinyl chloride monomer and 30,000 tons of polyvinyl chloride annually, and an I.V.P.-Ashland Chemical Co. project for the production of 40,000 tons of isoprene and poly-isoprene and 38,000 tons of methanol per year.

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Table 7.—Venezuela: Distribution of landholdings, crude oil production, and refining capacity, by companies, 1969

Company	Principal ownership or affiliation	Nationality of ownership	Concessions [1] and assignations [2] as of Dec. 31, 1969 (hectares)	Crude oil production (thousand 42-gallon barrels)	Refining capacity as of Dec. 31, 1969 (thousand 42-gallon barrels daily)
PRIVATE					
Caracas Petroleum, S.A.	Ultramar Co., Ltd.	British	29,883	2,263	-----
Chevron Oil Co. de Venezuela, S.A.	Standard Oil Co. of California	United States	108,625	17,893	62
Cía. Shell de Venezuela, Ltd.	Royal Dutch/Shell Group	British/Dutch	301,428	338,569	404
Cía. Española de Petróleos, S.A.	Cía. Española de Petróleos, S.A.	Spanish	10,546	-----	-----
Continental Oil Co. of Venezuela	Continental Oil Co.	United States	797	4,045	-----
Coro Petroleum Co.	Texaco, Inc.	----do	70,865	3,783	-----
Creole Petroleum Corp.	Standard Oil Co. (New Jersey)	----do	651,833	559,866	524
International Petroleum (Venezuela), Ltd.	----do	----do	6,133	625	-----
King Mill Oil Co., C.A.	King Mill Oil Co.	----do	4,970	-----	-----
Mene Grande Oil Co., C.A.	Gulf Oil Corp.	----do	600,227	145,432	-----
Mito Juan Concesionaria de Hidrocarburos, C.A.	Venezuelan investors	Venezuelan	27,296	756	-----
Mobil Oil Co. de Venezuela	Mobil Oil Corp.	United States	144,054	38,931	100
Pan American Venezuelan Oil Co.	Standard Oil Co. (Indiana)	----do	5,500	86	-----
Phillips Petroleum Co.	Phillips Petroleum Co.	----do	45,470	16,256	4
Signal Oil and Gas of Venezuela	Signal Companies, Inc.	----do	7,000	3,745	-----
Sinclair Venezuelan Oil Co.	Atlantic Richfield Co.	----do	97,897	18,778	45
Sociedad Anónima Petrolera (Petmer) Las Mercedes	Texaco, Inc., and Ultramar Co., Ltd.	United States/British	63,026	1,290	-----
Talón Petroleum Co., C.A.	Kirby Petroleum Co.	United States	60,167	1,260	-----
Texaco Maracaibo, Inc.	Texaco, Inc.	----do	3,147	31,770	-----
Texas Petroleum Co.	----do	----do	124,328	24,691	10
Venezuelan American Independent Oil Producers Association, Inc.	Atlantic Richfield Co., Sun Oil Co., Texaco, Inc.	----do	841	-----	-----
Venezuelan Atlantic Refining Co.	Atlantic Richfield Co.	----do	24,751	-----	-----
Venezuelan Gulf Refining Co.	Gulf Oil Corp.	----do	-----	-----	159
Venezuelan Sun Oil Co.	Sun Oil Co.	----do	20,000	90,641	-----
Total private companies			2,408,784	1,300,630	1,308
Venezuelan Government:					
Corporación Venezolano de Petróleo (C.V.P.)			699,247	11,202	16
Grand total			3,108,031	1,311,832	1,324

[1] To private companies.
[2] To the Government.
Source: Ministerio de Minas e Hidrocarburos. Memoria y Cuenta, Año 1969, Caracas, Venezuela, March 1970.

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The Mineral Industry of Yugoslavia

By Roman V. Sondermayer [1]

During 1969 Yugoslavia produced a large variety of mineral products, remaining a leading European producer of nonferrous metals and ranking fourth after the U.S.S.R., Rumania, and West Germany in European crude oil production. Bauxite, antimony, copper, lead, and zinc ores and metals and nonmetallics such as barite, feldspar, magnesite, and pyrite were among the more important minerals produced. Iron and steel output continued inadequate to cover demand, and substantial imports of iron and steel semimanufactures were required. Although Yugoslavia is one of the leading European crude oil producers, output of mineral fuels was below domestic requirements, necessitating supplemental imports of high-rank coals and liquid fuels. Power shortages adversely influenced mineral production.

Major activities in the mineral industry of Yugoslavia in 1969 included the construction of an aluminum smelter near Titograd in Montenegro, the planning and financial arrangements for two alumina plants located near Mostar in Hercegovina and near Šibenik in Dalmacia, the discovery of a large iron ore deposit near Ljubija in Bosnia, the commissioning of a new iron ore mine at Tajmište in Macedonia, the expansion of the Pančevo fertilizer plant, the discovery of a new oilfield near the village of Beničanci in Croatia, and intensive exploration for crude oil on the Adriatic Coast.

Although mineral trade between the United States and Yugoslavia was modest, mining machinery and related equipment together with technical know-how have remained a strong area for U.S. suppliers. Although no conclusive contracts have been made, Yugoslavs displayed particular interest in U.S. participation in the mining and processing of nickel, antimony, and aluminum and in offshore drilling.

PRODUCTION

During 1969 the policy of limited investments continued. Consequently, to maintain or increase mineral output, producers directed their efforts toward better utilization of existing facilities rather than construction of new ones. Closing of unprofitable mines and conversion to opencast mining whenever possible was common. Mechanization of both underground and opencast mines proceeded at a more rapid pace than in 1968.

In spite of better mechanization, productivity per man-shift of Yugoslav miners was lower than the average productivity of miners in Western Europe.

Petroleum exploration, production, and refining, although modest by world standards, were generally perfomed by modern and efficient methods. All three primary methods of oil production (flowing, pumping, and gas lifting) were used; secondary recovery methods (repressuring and waterflooding) were employed at older fields. Chemical and hydraulic methods for stimulation of crude oil production were widely used during 1969.

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[1] Petroleum engineer, Bureau of Mines, Washington, D.C.

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Table 1.—Yugoslavia: Production of selected mineral and metal commodities

(Metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969 p
METALS			
Aluminum:			
Bauxite, gross weight thousand tons	2,131	2,072	2,182
Alumina, gross weight	101,403	118,082	e 119,000
Metal, including secondary	44,574	48,080	48,370
Antimony:			
Mine output, metal content	3,079	r 2,657	e 3,000
Metal (regulus)	2,297	1,755	2,037
Bismuth, metal [2]	107	86	102
Cadmium, metal [2 e]	150	150	150
Chromite, gross weight	47,162	r 45,261	39,434
Copper:			
Mine output, metal content	63,152	r 70,487	e 88,000
Blister, including secondary	76,707	r 83,821	e 89,000
Refined (electrolytic):			
Primary	50,685	59,421	78,326
Secondary	15,554	10,633	3,677
Gold [2] troy ounces	68,064	70,314	NA
Iron and steel:			
Iron ore and concentrate thousand tons	2,580	2,720	2,721
Pig iron do.	1,177	1,201	1,198
Ferroalloys, all types do.	79	85	90
Steel ingots and castings do.	1,832	1,997	2,220
Semimanufactures do.	1,176	1,510	1,570
Lead:			
Mine output, metal content of ore	108,079	r 111,768	e 123,000
Metal:			
Smelter, crude, including secondary	101,890	r 108,715	120,000
Refined, including secondary	93,805	94,833	106,952
Manganese, ore and concentrates, gross weight	9,821	14,136	12,331
Mercury 76-pound flasks	15,890	14,794	14,330
Selenium, elemental kilograms	4,644	9,637	9,000
Silver, metal, including secondary [2] thousand troy ounces	3,075	2,577	3,456
Zinc:			
Mine output, metal content	90,017	r 95,474	e 98,000
Metal, including secondary	53,188	78,978	81,059
NONMETALS			
Asbestos	9,021	10,393	11,461
Barite	84,478	70,486	e 71,000
Cement, hydraulic thousand tons	3,813	3,765	3,964
Clays, fire clay:			
Crude	168,004	r 178,192	e 180,000
Burned	34,667	r 38,410	e 40,000
Feldspar, crude	36,996	r 44,038	e 45,000
Fertilizer materials, manufactured:			
Nitrogenous:			
Gross weight thousand tons	505	661	917
Nitrogen content [4] do.	101	132	183
Phosphatic:			
Gross weight do.	1,235	1,072	687
P_2O_5 content [5] do.	204	177	113
Gypsum:			
Crude	170,925	r 196,630	e 200,000
Calcined	43,747	r 52,218	e 60,000
Lime:			
Quicklime thousand tons	r 941	r 983	e 1,000
Hydrated lime do.	258	r 323	e 350
Magnesite:			
Crude	424,762	400,316	477,000
Sintered	r 149,516	156,301	193,160
Caustic calcined	17,807	17,074	e 17,000
Mica, all grades kilograms	118,659	143,501	NA
Pyrites:			
Gross weight	424,648	r 273,663	e 272,000
Sulfur content	178,352	r 114,938	e 114,000
Quartz, quartzite, and glass sand thousand tons	629	660	NA
Salt:			
Marine	40,776	10,574	NA
Evaporated	127,656	127,000	NA
Other	-------	41,426	NA
Total	168,432	179,000	212,000
Stone, sand and gravel:			
Gravel and sand excluding glass sand thousand cubic meters	6,092	6,644	e 7,000
Dimension stone and marble facing square meters	305,527	369,631	e 370,000
Broken stone and marble thousand cubic meters	2,171	2,128	e 2,200

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Table 1.—Yugoslavia: Production of selected mineral and metal commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969 [p]
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	12,423	[r] 8,986	[e] 10,000
Coal:			
Bituminous thousand tons	908	835	682
Brown do	9,023	9,508	9,442
Lignite do	16,535	16,389	16,378
Coke:			
Metallurgical thousand tons	1,157	1,178	NA
Breeze do	62	51	NA
Gaswork do	7	2	NA
Total	1,226	[r] 1,236	1,226
Fuel briquets, all grades	23,909	[r] 33,635	[e] 30,000
Gas:			
Manufactured (city gas only) million cubic feet	2,413	2,641	[e] 2,600
Natural, gross production do	16,313	20,615	25,784
Petroleum:			
Crude oil thousand tons	2,374	2,494	2,699
Refinery products:			
Gasoline, all kinds do	886	935	1,008
White spirits do	17	18	19
Kerosine and jet fuels do	94	119	140
Distillate fuel oils do	1,389	1,380	1,723
Residual fuel oils do	1,816	1,847	1,968
Lubricants do	138	103	88
Asphalt and bitumen, including natural do	171	245	314

[e] Estimated. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition in 1969 Yugoslavia produced bentonite, diatomite, germanium, kaolin, liquefied natural and petroleum gases, blast furnace gases, and petroleum coke, but statistics were not available.

[2] All as byproduct of lead and zinc production.

[3] Most as byproducts of copper production.

[4] Calculated on basis of 20 percent nitrogen content as reported in source material.

[5] Calculated on basis of 16.5 percent P_2O_5 content as reported in source material.

TRADE

Trade tables show the principal flow of mineral materials during 1968, the latest year for which data were available. Nonferrous metals constituted the largest export commodity group, and iron and steel together with liquid fuels accounted for the major portion of the country's mineral imports. West Germany was the principal mineral importer and the U.S.S.R. the principal supplier.

Table 2.—Yugoslavia: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite thousand tons	1,813	1,846
Oxide and hydroxide (alumina only)	11,568	20,866
Metal, including alloys:		
Scrap	158	4,168
Unwrought	6,324	20,485
Semimanufactures	18,431	22,301
Antimony metal, including alloys, all forms	1,747	1,288
Bismuth metal, including alloys, all forms	65	45
Cadmium metal, including alloys, all forms	12	72
Chromium, chromite, concentrates	6,920	9,260
Copper metal, including alloys:		
Scrap and filings	437	226
Unwrought	1,420	9,358
Semimanufactures	29,160	34,219
Iron and steel:		
Ore and concentrate, except roasted pyrite	91,154	97,345
Roasted pyrite	524	2,369
Metal:		
Scrap	42,355	28,322
Pig iron, ferroalloys, and similar materials	116,084	51,648
Steel, primary forms	10,042	35,048
Semimanufactures:		
Bars, rods, angles, shapes, sections	98,030	128,065
Universals, plates, and sheets	15,591	14,893
Hoop and strip	779	9,542

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Table 2.—Yugoslavia: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS—Continued		
Iron and Steel—Continued		
Semimanufactures—Continued		
Rails and accessories	38,020	9,932
Wire (excluding wire rods)	12,366	7,947
Tubes, pipes, and fittings	73,378	64,659
Castings and forgings, rough	9,013	7,164
Total	247,177	242,202
Lead metal, including alloys:		
Unwrought	54,641	55,147
Semimanufactures	1,547	619
Manganese ore and concentrates	990	42
Mercury—76-pound flasks	14,678	14,172
Nickel metal, including alloys, all forms	60	181
Platinum-group metals; Palladium—thousand troy ounces	8	23
Selenium, elemental—kilograms	4,735	17,743
Silver metal, including alloys—thousand troy ounces	2,616	2,320
Titanium metal, including alloys, all forms	54	-------
Zinc:		
Ore and concentrate	2,836	9,205
Oxide	1,223	1,004
Zinc metal, including alloys:		
Blue powder	2,992	2,566
Unwrought	5,218	30,622
Semimanufactures	7,659	11,040
NONMETALS		
Asbestos	1,660	1,570
Barite and witherite	45,028	52,093
Cement:		
Portland	143,874	110,856
Other	18,472	33,882
Clay and clay products (including all refractory brick):		
Crude clays:		
Bentonite	26,234	23,746
Fire clay	4,220	8,854
Kaolin (china clay)	91	188
Other	780	-------
Products:		
Refractory	48,923	44,150
Nonrefractory	184,295	3,360
Diatomite	1,667	1,420
Feldspar	20,630	15,481
Fertilizer materials, manufactured:		
Nitrogenous	1,361	787
Phosphatic	288,603	346,067
Gypsum and plasters	191	48
Lime	1,578	1,781
Magnesite:		
Raw	3,580	75
Calcined	12,378	13,939
Sintered	68,517	93,553
Pyrites (gross weight)	96,406	106,726
Stone, sand and gravel:		
Dimension stone, crude, partly worked, and worked	51,462	49,734
Gravel and crushed rock	6,632	42,869
Sand, excluding metal bearing	4,646	6,397
Sulfur:		
Elemental, all forms	1,602	4,949
Sulfuric acid	8,087	56,505
Talc, steatite, soapstone, and pyrophyllite	5	101
MINERAL FUELS AND RELATED MATERIALS		
Carbon black and gas carbon:		
Carbon black	641	1,114
Coal:		
Bituminous coal	2,269	1,506
Dust	84,968	65,425
Brown coal	16,064	9,323
Lignite	80,362	21,895
Gas, liquefied, all kinds	10,844	9,993
Petroleum:		
Crude and partly refined	321,805	292,201
Refinery products:		
Gasoline (including natural)	91,204	128,423
Kerosine and jet fuel	18,732	17,725
Distillate fuel oil	276,418	39,030
Residual fuel oil	270,479	76,021
Lubricants	55,170	15,773
Mineral jelly and wax	132	-------
Other	9,202	3,103
Total	716,337	280,075

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Major destinations of selected commodities, 1968

(Metric tons unless otherwise specified)

Commodity	Quantity
METALS	
Aluminum:	
Bauxite, total thousand tons	1,846
U.S.S.R. do	717
West Germany do	589
Italy do	258
Rumania do	105
Czechoslovakia do	95
East Germany do	70
Metal, including alloys:	
Unwrought, total	20,485
West Germany	5,581
Spain	5,525
Israel	3,350
Semimanufactures, total	22,301
United States	7,149
Czechoslovakia	2,612
Poland	2,540
Sweden	1,660
Antimony, metal; including alloys, all forms, total	1,288
United States	795
Italy	387
Copper: Metal, including alloys:	
Unwrought, total	9,358
United States	9,008
Italy	304
Semimanufactures, total	34,219
United States	6,848
Italy	6,220
U.S.S.R.	5,640
West Germany	3,476
United Kingdom	1,918
Iron and steel: Semimanufactures, total	242,202
Italy	50,612
Rumania	34,952
U.S.S.R.	31,377
East Germany	23,878
West Germany	22,910
Lead, metal including alloys, unwrought, total	55,147
United States	19,455
U.S.S.R.	17,190
Austria	8,906
Poland	5,494
Czechoslovakia	1,807
METALS—Continued	
Mercury, total 76-pound flasks	14,172
United States do	5,646
United Kingdom do	3,301
West Germany do	2,077
U.S.S.R. do	2,030
Selenium, elemental, total kilograms	17,743
West Germany do	17,153
Zinc, metal, including alloys, unwrought total	30,622
United Kingdom	12,450
Italy	8,272
United States	2,659
U.S.S.R.	2,013
NONMETALS	
Cement, all types, total	144,738
Malta	33,666
Brazil	28,750
Ghana	26,000
Saudi Arabia	16,182
Clay products (including refractory brick), total	44,150
Rumania	16,956
West Germany	9,569
Poland	4,927
Italy	4,235
Fertilizer materials, manufactured: Phosphatic, total	346,067
Bulgaria	345,150
Magnesite, sintered, total	93,553
United States	25,952
Italy	16,151
Poland	13,190
United Kingdom	12,866
Pyrites (gross weight), total	106,726
United Arab Republic	47,697
East Germany	27,593
Czechoslovakia	15,022
MINERAL FUELS AND RELATED MATERIALS	
Petroleum:	
Crude and partly refined, total	292,201
Austria	292,201
Refinery products, total	280,075
Austria	66,724
United Kingdom	62,357
Italy	56,488

Table 3.—Yugoslavia: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Bauxite and concentrate	7,816	9,961
Oxide and hydroxide (alumina)	3,449	1,046
Metal, including alloys:		
Unwrought	25,299	21,659
Semimanufactures	2,783	4,349
Antimony metal, including alloys, all forms	105	-------
Chromium:		
Chromite	43,963	75,488
Oxide and hydroxide	353	304
Metal, including alloys, all forms	7	1
Cobalt:		
Oxide and hydroxide	24	11
Metal, including alloys, all forms	29	45
Columbium and tantalum: Tantalum metal, including alloys, all forms kilograms	8	45

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Table 3.—Yugoslavia: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS—Continued			
Copper:			
Ore and concentrate		497	4,917
Metal, including alloys:			
Scrap		1,490	1,067
Unwrought:			
Blister and other unrefined, unalloyed		609	6,002
Refined and alloys		15,588	15,846
Semimanufactures		5,486	6,807
Iron and steel:			
Ore and concentrate		128,206	200,807
Metal:			
Scrap		25,702	-------
Pig iron, including cast iron		140,844	146,093
Sponge iron, powder, and shot		740	899
Ferroalloys:			
Ferromanganese		2,108	2,529
Other		1,094	1,921
Primary steel forms:			
Ingots		24,276	9,660
Blooms, billets, slabs, sheet and bars		61,091	99,970
Steel semimanufactures:			
Bars, rods, angles, shapes, and sections		209,276	91,115
Universals, plates, and sheets		448,103	396,991
Hoop and strip		74,641	60,531
Rails and accessories		2,811	2,572
Wire		26,467	15,813
Tubes, pipes, and fittings		40,217	38,223
Castings and forgings, rough		1,858	1,304
Total		802,873	606,549
Lead:			
Ore and concentrate		6,783	12,260
Oxides		530	533
Metal, including alloys:			
Scrap		1,768	152
Unwrought		8,385	8,547
Semimanufactures		244	325
Manganese:			
Ore and concentrate		49,032	35,562
Oxides		395	394
Metal, including alloys, unwrought		51	-------
Mercury	76-pound flasks	9	722
Nickel:			
Matte, speiss, and similar materials		18	15
Metal, including alloys:			
Unwrought		r422	815
Semimanufactures		r580	720
Platinum-group metals and silver, including alloys:			
Platinum	troy ounces	19,612	52,871
Silver	do	433,874	887,038
Selenium, elemental	kilograms	840	1,905
Tin:			
Oxides	long tons	11	21
Metal, including alloys:			
Unwrought	do	1,798	1,386
Semimanufactures	do	28	60
Titanium:			
Ore and concentrate		1,699	1,005
Oxides		3,925	4,594
Metal, including alloys, all forms	kilograms	250	682
Tungsten metal, including alloys, all forms	do	11,592	6,575
Zinc:			
Ore and concentrate		21,754	42,108
Oxide		245	47
Metal, including alloys:			
Scrap		20	26
Unwrought		2,233	7,646
Semimanufactures		334	189
Other:			
Ores and concentrates		4	315
Ash and residues containing nonferrous metals		2,160	104

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Table 3.—Yugoslavia: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc.	695	891
Dust and powder of precious and semiprecious stones.....kilograms	29	11
Grinding and polishing wheels and stones	623	833
Asbestos	18,644	17,125
Boron materials:		
Crude natural borates	1,850	308
Oxide and acid	285	8,459
Cement	990,106	703,670
Chalk	522	265
Clay and clay products:		
Crude clays, n.e.s.:		
Bentonite	80	114
Fire clay	34,666	36,540
Fuller's earth, dinas, chamotte	158	1,155
Kaolin	26,515	29,702
Other	378	3,458
Products:		
Refractory (including nonclay bricks)	12,400	15,745
Nonrefractory	22,804	30,822
Diamond, industrial.....kilograms	74	11
Diatomite and other infusorial earths	594	651
Fertilizer materials:		
Crude:		
Phosphatic	694,245	796,975
Potassic	8,325	12,521
Manufactured:		
Nitrogenous	433,809	407,667
Phosphatic:		
Thomas slag	62,925	19,100
Other	6,095	5,000
Potassic	175,466	191,267
Fluorspar	1,193	1,870
Graphite, natural	1,141	892
Mica:		
Crude, including splittings and waste	536	70
Worked, including agglomerated splittings	35	31
Precious and semiprecious stone, except diamond	130	419
Pyrite (gross weight)	20	22
Salt	123,710	186,521
Sodium and potassium compounds:		
Caustic soda	14,301	14,854
Caustic potash, sodic and potassic peroxides	618	1,342
Stone, sand and gravel:		
Dolomite, chiefly refractory grade	2,787	3,745
Gravel and crushed rock	15,144	64,164
Limestone, except dimension	11,511	14,895
Quartz and quartzite	713	2,133
Sand, excluding metal bearing	11,427	66,811
Sulfur:		
Elemental, all forms	21,237	20,013
Sulfuric acid	448	29
Talc, steatite, soapstone, and pyrophyllite	668	701
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	4,424	14,194
Carbon black and gas carbon	3,974	3,184
Coal and briquets:		
Anthracite and bituminous coal	1,444,588	1,742,231
Briquets of anthracite and bituminous coal	22,004	13,047
Coke and semicoke	114,384	110,193
Petroleum:		
Crude and partly refined	2,589,524	2,718,882
Refinery products:		
Gasoline (including natural)	26,838	34,060
Kerosine and jet fuel	13,235	26,362
Distillate fuel oil	r 311,341	296,031
Residual fuel oil	264,967	535,400
Lubricants	36,615	38,574
Mineral jelly and wax	4,176	3,704
Other	r 76,497	89,827
Total	r 733,669	1,023,958

r Revised.

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Major origins of selected commodities, 1968

(Metric tons unless otherwise specified)

Commodity	Quantity
METALS	
Aluminum:	
Metal, including alloys, unwrought, total	21,650
U.S.S.R.	18,208
Semimanufactures including alloys, total	4,349
West Germany	1,524
Austria	1,314
Italy	646
Chromium, chromite, total	75,488
Albania	69,534
Iran	4,234
Turkey	1,720
Copper, metal including alloys, unwrought, total	21,848
United Kingdom	18,179
Iron and steel:	
Primary forms, total	109,630
U.S.S.R.	62,623
Poland	27,755
Rumania	9,148
Bulgaria	7,512
Semimanufactures, total	606,549
West Germany	152,758
Italy	107,728
U.S.S.R.	87,751
Poland	51,054
Czechoslovakia	48,961
Lead ore and concentrate, total	12,260
Australia	9,881
West Germany	1,933
Metal including alloys, unwrought, total	8,547
Switzerland	5,022
Netherlands	1,291
Manganese ore and concentrate, total	35,562
U.S.S.R.	24,339
Netherlands	9,420
Platinum, total troy ounces	52,871
West Germany do	52,216
Tin, metal, including alloys, all forms, total long tons	1,386
United Kingdom do	296
Indonesia do	233
West Germany do	218
Tungsten, metal including alloys, unwrought, total kilograms	6,575
France do	4,851
Netherlands do	825
Austria do	811
Zinc, ore and concentrate, total	42,108
Czechoslovakia	17,602
West Germany	11,558
Italy	6,934
Switzerland	4,600
Metal including alloys, unwrought, total	7,646
Bulgaria	2,665
Zambia	2,500
Italy	2,100
NONMETALS	
Asbestos, all forms, total	17,125
U.S.S.R.	9,582
Canada	4,149
Swaziland	2,138
Cement, all kinds, total	703,670
Rumania	346,275
Czechoslovakia	128,933
Hungary	108,335
Bulgaria	46,574
Clays and clay products:	
Crude clays, n.e.s.:	
Fire clay, total	36,540
Czechoslovakia	21,767

Commodity	Quantity
NONMETALS—Continued	
Clays and clay products—Continued	
Crude clays, n.e.s.—Continued	
Fire clay—Continued	
Poland	12,737
West Germany	1,957
Kaolin, total	29,702
Czechoslovakia	17,312
East Germany	7,729
United Kingdom	1,750
Greece	1,740
Products:	
Refractory (including nonclay bricks) total	15,745
West Germany	4,328
U.S.S.R.	3,471
Austria	3,216
Italy	1,662
Nonrefractory, total	30,822
Italy	21,089
Poland	3,578
Czechoslovakia	2,489
East Germany	1,184
Fertilizer materials:	
Crude:	
Phosphatic, total	796,975
Tunisia	333,297
Jordan	184,295
United Arab Republic	96,878
Israel	93,449
Potassic, total	12,521
East Germany	12,521
Manufactured:	
Nitrogenous total	407,667
U.S.S.R.	99,071
Austria	83,001
Italy	65,567
West Germany	51,134
Phosphatic:	
Thomas slag, total	19,100
United Arab Republic	19,100
Other, total	5,000
United States	5,000
Potassic, total	191,267
East Germany	94,570
U.S.S.R.	92,971
Salt, total	136,521
Rumania	98,824
United Arab Republic	20,425
Tunisia	17,025
Sulfur, elemental, all forms, total	20,013
Poland	8,515
U.S.S.R.	6,593
Italy	2,792
MINERAL FUELS AND RELATED MATERIALS	
Anthracite and bituminous coal, total	1,742,231
U.S.S.R.	1,145,765
United States	432,823
Czechoslovakia	140,646
Petroleum:	
Crude and partly refined, total	2,718,882
U.S.S.R.	1,229,534
Iraq	854,514
Libya	294,052
Iran	172,536
Refinery products, total	1,023,958
U.S.S.R.	570,947
Rumania	202,742
Bulgaria	48,731
Italy	46,951
Hungary	32,624
Poland	22,034
United States	22,812

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COMMODITY REVIEW

METALS

Aluminum.—The Yugoslav aluminum industry had a successful year in 1969. In addition to the continued production and exports of bauxite, most of the industry's activities were concentrated on new aluminum and alumina facilities located in Titograd, Crna Gora; Mostar, Hercegovina; and Šibenik, Dalmacia.

In Bosnia a new large bauxite deposit was discovered near the Vlasenica bauxite mine. The new deposit, with reported reserves of 18 million tons of bauxite, is located near the village of Podbraćan. Some Yugoslav experts believe that the total reserves of this area could reach 60 million tons of bauxite, with an average aluminum content of 55 percent.

Construction of an alumina-aluminum plant at Titograd continued during 1969. Pechiney (Compagnie des Produits Chimiques et Électrométallurgiques) provided the technical know-how. The plant is scheduled to go on stream in 1972 with an annual capacity of 200,000 tons of alumina and 50,000 tons of aluminum.

A management contract for the Mostar alumina plant was concluded between Energo-Invest from Sarajevo and Pechiney. Pechiney is to provide technical information for the plant operation. The facility will have a capacity of 200,000 tons of alumina with a possibility of adding a 50,000-ton-per-year aluminum plant. All work preliminary to construction, including financing arrangements, was completed at yearend.

Alusuisse is to supply technical assistance for the construction of a 50,000-ton-per-year aluminum plant at Šibenik. Total investment for the new aluminum plant will be around 430 million new dinars.[2] Reportedly the plant will start production in 1972. The new facility will be operated by the existing aluminum smelting and rolling enterprise Tvornica Lakih Metal Boris Kidrič in Šibenik.

Representatives from East Germany and Yugoslavia examined possibilities of building an alumina plant at Obrovac, where large bauxite deposits are exploited by Yugal. Results of these talks were not made public.

Copper.—The mine and smelter at Bor and the mine at Majdanpek remained the focal points of the copper industry in 1969, and at the same time the second phase of their expansion was continued. At Bor the construction of a new mine shaft 500 meters deep and a concrete head frame 80 meters high continued without problems. Early in the spring four new facilities went on stream in Bor. A new gold plant, of undisclosed capacity, was equipped by the West German Company, Salzgitter. Plant personnel were trained in Finland. A pyrite roasting plant, a compressor station, and a copper leaching plant with a capacity of about 500 tons of copper per year also went on stream. Later in the year a new electrolytic plant was added to the facilities at Bor. With two electrolytic plants in operation Bor will have the capacity to produce 100,000 tons of electrolytic copper per year. Construction of a 120,000-ton-per-year sulfuric acid plant started in the fall. The plant will reportedly be completed in 1972.

At the Majdanpek mine, the seventh flotation section was completed in the summer of 1969. The installation will have a capacity of 1.35 million tons of ore per year.

In addition to investments in new facilities the Bor Copper Mine and Smelter Complex was spending about 15 percent of its net profit on research. The principal research activities centered around the problem of improved recovery of byproducts from copper ore. Aside from silver and gold the Bor and Majdonpek ore also contains platinum, gallium, rhenium, tellurium, iridium, germanium, selenium, vanadium, etc. At yearend magnetite and kaolin recovery problems had been resolved. It is expected that research will increase recovery of silver and gold.

Iron and Steel.—The discovery of a high-quality iron ore deposit near the existing mine of Ljubija in Bosnia, the commissioning of the Tajmište mine in Macedonia, and the modernization of existing iron and steel plants were the major events in the country's iron and steel industry during 1969.

A rich find of limonite iron ore was made at Omarska, Bosnia, in the general area of the Ljubija mines. Public announcements

[2] Where necessary values have been converted from Yugoslavian dinars (Din.) to U.S. dollars Dinn. 12.5 = US$1.00.

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set the iron ore reserves at 250 million tons with an average iron content of 54 to 60 percent.

In Macedonia near Kičevo, Tajmište, a new iron ore mine and beneficiation facility went on stream in the fall of 1969. About 123 million tons of ore reserves were reported in the area. Production from the opencast mine should reach its optimal output of 8.5 million tons of ore per year in 1974. Reportedly the average iron content of ore is 35 percent. The beneficiation facilities will be able to produce about 800,000 tons of concentrate per year with an average iron content of 42 percent. The Skopje iron and steel plant is to be the principal consumer of this iron ore.

Reconstruction and modernization of existing iron and steel plants continued throughout the year. In the Zenica iron and steel plant most of the contracts for equipment purchases and for expansion activities were completed, consuming the largest part of a $70 million foreign credit. The modernization of the steel plant is to be completed by 1972, when annual output should reach 2 million tons, doubling the present output. In the Smederevo iron and steel works expansion activities continued and contracts were concluded with East Germany for delivery of equipment for a cold-rolling mill of 200,000 tons annual capacity. At the Sisak iron and steel plant a new galvanizing plant was under construction. Reports indicated that production will start in May 1970, but capacity of the new facility was not disclosed. At the Nikšić iron and steel works, preparation for a fundamental modernization was underway. The Yugoslav enterprise Progress-Invest will finance and provide engineering for the modernization, which will raise the output of high-quality steel from 130,000 tons to 270,000 tons. The Skopje iron and steel works is under an expansion program that should bring the output of the plant to 940,000 tons in 1971.

Lead and Zinc.—Modernization of existing mines, development of new ones, and construction of a lead and zinc smelter at Titov Veles were the principal activities of the lead and zinc industry of Yugoslavia during 1969. At Trepca's largest mine, Stari Trg, a new shaft was being sunk with the assistance of a British firm.

The development of Badovac mine (sometimes called Kriva Feja) in Serbia continued. Preliminary reports indicate reserves of 5 million tons of lead and zinc ore containing about 5 percent lead and 7 percent zinc. Mine capacity will be 300,000 tons of ore per year. The ore will be moved to a beneficiation plant at Kriva Feja by rail through a 17 kilometer long tunnel.

Near Priština, the first opencast lead and zinc mine and a new flotation plant went into production as a part of Trepča's Kišnica and Novo Brdo operations. The opencast mine has a capacity of 300,000 tons of ore per year. Average metal content of the ore was reported to be 2.3 percent lead, 1.1 percent zinc, and 40 grams of silver per ton. Reserves were reported to be adequate to support present production for 25 years. The nearby flotation plant has a capacity of 600,000 tons of ore per year. Plant equipment was imported from the U.S.S.R.

At the Ajvalija mine deepening activities were extended an additional 150 meters, bringing total depth to 400 meters. Equipment for the shaft will be purchased in East Germany.

Financial arrangements for construction of a lead and zinc smelter at Titov Veles in Macedonia were finalized during 1969. The principal contract was between Rudnap Export-Import of Belgrade, and the British firm, Gas Corporation Ltd. of Stockton-on-Tees. which will deliver the smelter. The $10.8 million loan to finance the project is being made by Lazard Bros. and Co. Ltd., acting on behalf of a syndicate of banks from the United Kingdom. The loan is repayable over 10 years. Although various annual capacity figures for the new smelter have been reported, latest published data indicated a production capacity of 75,000 tons of lead, 52,000 tons of zinc, and 120,000 tons of sulfuric acid by 1972.

Nickel.—Apparently Le Nickel will lead a French-Yugoslav joint venture to produce nickel from a lateritic deposit near Kavadarci in Macedonia. Reportedly the metal content of ore is 1 percent. The project includes mining and processing facilitiies, and planners set the output at about 12,000 tons of nickel per year. At yearend the arrangement was not finalized and Yugoslav author-

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ities were trying to interest U.S. companies in the operation.

NONMETALS

During 1969 the nonmetals industry of Yugoslavia produced a large variety of commodities. However, producers of cement, magnesite, manufactured fertilizers, and salt were the most active members of the nonmetallic sector.

Bentonite.—Bentomak, Bentonite, and Industrija Nafte (INA) remained the largest Yugoslav producers of montmorillonite clays, with a total capacity of 100,000 tons per year.

Bentomak put into operation a new processing facility at Kriva Palanka in the fall of 1969. The new plant has a capacity of 30,000 tons per year. West Germany provided the technical know-how and delivered equipment for the fully automated plant. The process activities locally mined calcium montmorillonite by the usual process of exchange.

Cement.—The activities of the cement industry of Yugoslavia were thoroughly examined during 1969 because severe shortages of cement slowed down many construction projects. Consequently, principal activities of the industry were centered on increasing production of existing plants and planning new ones.

A new section with a capacity of 1,200 tons of cement per day was under construction at the existing factory of Dalmacija Cement at Prvobarac. Reportedly the highly automated plant will use the Humbolt (West Germany) preheat process. The facilities of the Beočin cement factory were expanded, and a rotary kiln of 500 tons daily capacity was under construction. According to reports, completion of the expansion program was scheduled for 1970, and new annual plant capacity will reach 1,350,000 tons. In addition, a new limestone quarry was planned near the village Besenovo.

At the Usje cement factory near Skopje plans for a new segment with an annual capacity of 400,000 tons of cement were underway. The addition, scheduled for completion in 1971, will bring total plant capacity to 1,000,000 tons per year.

The modernization of the Trbovlje cement plant continued in 1969. When completed in 1971, the annual capacity will be increased from 200,000 tons to 580,000 tons. During 1969 proposals for construction of several new cement plants were discussed by the Chamber of Economics and in the press. Six new plants were mentioned, but most of them were only in the planning stage without secured financing. Bosnia took the lead with proposed plants at Doboj (530,000 tons per year), Lukovac (320,000 tons per year), and Goražde (200,000 tons per year). In addition, one plant was planned for Serbia at Kosjerić (400,000 tons per year), one for Montenegro Plevlje (320,000 tons per year), and one Croatia near Našice (400,000 tons per year).

Fertilizers.—Expansion of the fertilizer industry continued during 1969. The second phase of expansion for the Pančevo nitrogenous fertilizer plant in Serbia was completed in the fall. Using a U.S. process, the plant's annual capacity was increased from 420,000 tons to 1,300,000 tons of nitrogenous fertilizer. The expansion of the Zorka chemical complex at Sabac was completed in October 1969. The complex includes a 500,000-ton-per-year phosphoric acid plant and a 100,000-ton-per-year triple-superphosphate unit. The Kutina nitrogenous fertilizer plant near Kutina, Croatia, which went on stream in the summer of 1968, reached its capacity output of 800,000 tons of fertilizers in 1969.

Magnesite.—At the Bela Stena magnesite mine near Kraljevo, a new separating plant was under construction. The plant will have a capacity of 100 tons per hour. Equipment for automatic separation of granules according to their specific gravity and up to the size of 60 millimeters will be delivered by the Belgian firm, Bassam. The nearby Magnohrom refactory materials factory will be the principal consumer of the magnesite.

Salt.—A new salt evaporation plant with an annual capacity of 100,000 tons was completed at yearend in Tuzla, the Yugoslav salt production center. The plan calls for additional facilities of 70,000 tons per year capacity to be built during the 2-year period starting in 1971. The merger of Tuzla salt mines with the Soda factory in Tuzla was approved by the authorities, and the new company, "Soda-So", was to start operating on January 1, 1970.

Sand and Gravel.—There were large numbers of primitive sand and gravel quarries in operation during 1969 in Yugoslavia. The Zaječar Quartz Sand Mine at Zaječar completed preparations for construction of a beneficiation plant and a sand mill. The

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capacity of the new facilities were reported to be approximately 40,000 tons of sand per year. In addition three new gravel plants were commissioned during 1969. One plant went on stream near Litija (140,000 cubic meters of gravel per year), the second went on stream near Veliko Orašje-Serbia (capacity 30 cubic meters per hour), and the third near Mala Krsna in Serbia (capacity 60 cubic meters per hour).

Wollastonite.—Large quantities of wollastonite were discovered near Brus in Serbia. Reserves were not disclosed. Preliminary plans call for opencast mining.

MINERAL FUELS

During 1969 coal remained the principal source of energy in Yugoslavia, although liquid fuels and natural gas made solid inroads in the energy market of the country. Because of large production of low-rank coals and modest domestic crude oil output, Yugoslavia remained an importer of anthracite, bituminous coal, coke, and liquid fuels. Larger use of natural gas was limited by lack of means for distribution and inadeguate industrial and home appliances. As in the past, difficulties were experienced in supplying large consumer centers with sufficient quantities of fuels. Shortages of coal, coke, liquid fuels, and electric power hampered industrial production in the winter of 1969.

Coal.—There were no spectacular events in the coal industry of Yugoslavia during 1969; however, the industry was making every effort to operate on a more competitive basis. Some small mines were closed, production at others was reduced, and some large mines were merged. Merger of the lignite mines Kreka and Banovići was finalized in early spring. The enterprise operated under the name Titovi Rudnici Kreka Banovići. In addition the Moluhe shaft, the oldest in the Kreka basin, was closed, and workers were reassigned to other mines. In the lignite basin near Plevlje a new opencast mine went into production, but capacity and other details were not disclosed.

The development of the Kosovo Mining, Power, and Chemical Combine at Obilić, based on large lignite reserves, continued during 1969. The gasification plant and the gas pipeline connecting Obilić with Skopje were near completion at yearend.

Petroleum and Natural Gas.—The petroleum industry of Yugoslavia made modest progress during 1969. As in the past domestic output of crude had to be supplemented by imports, mostly from the U.S.S.R. Principal events in the petroleum industry were the discovery of an oilfield near Beničanci; commencement of drilling operations in Jordan; ratification of the agreement on delineation of the continental shelf with Italy, and offshore exploration in Dalmacia.

In late summer 1969 a new oilfield was discovered near Beničanci in northeastern Croatia. The discovery was made by an Industrija Nafte (INA) drilling crew on a well located in the area between Donji Miholjac and Našice. The depth of the 100-meter-thick oil zone is about 1,870 meters, and the pay zone consists of porous dolomite of Mezosoic age. Preliminary test showed oil production of 1,300 barrels per day. Reportedly this is the most significant discovery made by INA in the past 3 years.

In the fall of 1969 INA started drilling its first exploratory well on a location 48 miles east of Amman in Jordan. Under the terms of the concession agreement INA is to finance the exploration program and to drill about 36,000 feet in the first 3 years of the contract. If oil is found, half of the expenses will be paid in oil. In addition INA will receive a 25-year concession renewable for another 15 years. Jordan is to get 12.5 percent royalty, and INA will pay a 50-percent income tax.

The agreement between Yugoslavia and Italy on delineation of the offshore boundary between the two countries was ratified and was in force at yearend.

INA was by far the largest oil enterprise in Yugoslavia. The State-owned enterprise operated oilfields in Croatia and Slovenia and refineries at Sisak Rijeka and Lendava. Drilling crews of INA drilled about 135,000 meters in 1969. The bulk of the drilling was in the Pannonian basin. However, INA was also active in both onshore and offshore exploration of the Adriatic basin in Dalmacia. Preparation for offshore drilling included contacts with offshore drilling operators from Western Europe and the United States since the Yugoslavs contend that Soviet organizations have not the capability nor experience for drilling offshore wells in a modern way.

INA accounted for roughly 70 percent of Yugoslavia's crude oil production in 1969. The largest share of INA's output came

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from Stružec oilfield. However, it appears that Žutica oilfield near Ivanić Grad will become the largest producing field in the country in 1970.

Naftagas, the other leading Yugoslav oil enterprise, operated oilfields in Serbia, explored in Macedonia, and managed refineries at Pančevo and Novi Sad. The drilling crews of Naftagas drilled about 65,000 meters in 1969. By far the greatest drilling activity was concentrated in the Pannonian basin in northern Yugoslavia. Some drilling activities were also reported in Macedonia. With an output of 775,000 tons of crude oil in 1969, Naftagas produced about 30 percent of the total country's output. About 440,000 tons came from the Kikinda oilfield, the largest one operated by Naftagas.

During 1969 there were six refineries in operation in Yugoslavia, all Government-owned, and their approximate annual capacities were reported as follows, in thousand of tons per year:

Operator	*Refinery*	*Capacity*
Independent Enterprise	Bosanski Brod	2,500
INA	Rijeka	2,400
Do	Sisak	1,400
Do	Lendava	200
Naftagas	Pancevo	1,400
Do	Novi Sad	600

The Rijeka refinery, the Modric plant of Bosanski Brod refinery, and the Novi Sad refinery were expanding their facilities. Two refineries, Pančevo and Novi Sad, were shut down in late December because of crude oil shortage.

The consumption of natural gas increased again in 1969. Obvious advantages of gas as fuel were attractive to many consumers. To speed up deliveries gas from the gas plant near Ivanić Grad to Zagreb, a new gas pipeline was completed in the winter of 1969. The pipeline is 40 kilometers long, with a diameter of 250 millimeters. The new pipeline is adjacent to the one built in 1955.

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The Mineral Industry of Zambia

By E. Shekarchi [1]

With copper exports accounting for 97 percent of export earnings, Zambia benefited from the repeated increases in copper prices during 1969. The copper industry has always made large contributions to the Government's revenue, and this fiscal dependence on copper earnings is likely to increase as a result of the Government's acquisition, effective January 1, 1970, of a 51-percent interest in the two holding companies which control the copper mines.

In 1969 the Government of Zambia adopted a number of new laws regulating all prospecting and mining and the taxation of mining activities. Salient features of the legislation follow:

All rights of ownership or partial ownership of minerals must revert to the State; the State has the option to take up 51 percent of the equity in any future mine, and in such case, pay its share of the prospecting and exploration costs; Special Grant areas in which no prospecting or mining activity had taken place since Independence revert to the States; in the case of existing mines the Special Grants are replaced by mining licenses, valid in the first instances for 25 years, and other Special Grants are to be replaced by prospecting or exploration licenses; where a mine is being worked under a tribute agreement, the actual operator will have the right to apply for a mining license; the royalty and export tax system for copper producers is to be replaced by a 51-percent mineral tax based entirely on profitability and a company tax on the balance of the profits.

The majority of the legislation reforms announced by the President were defined in the New Mines and Minerals Acts of October 1969 which became law on January 1, 1970.

It was announced that from April 1, 1970, the Industrial Development Corporation's (INDECO) industrial investments will be administered by a new holding company called Indeco Ltd. Fifty-one percent of the shares in the mining companies and the options attached to new prospecting licenses will be held by another new company called Mindeco Ltd. Both Indeco Ltd. and Mindeco Ltd. will be wholly owned subsidiaries of the Mining and Industrial Development Corporation of Zambia Ltd., whose chairman is to be President Kuanda.

Zambia and three other copper producing countries, Congo (Kinshasa), Peru, and Chile, formed a joint council in 1969 to promote and coordinate the export and exploitation of copper. The council is called Intergovermental Council of Copper Exporting Countries or Conseil Intergouvernemental des Pays Exportateurs de Cuivre (CIPEC).

Progress was reported on a $1.4-million [2] mineral survey which was begun in August 1969 by the Zambian Government and the United Nations Development Program (UNDP). It is scheduled for completion by the end of 1972.

The work of the Zambianization Committee for the mining industry, established in 1966, finally had results in the later part of 1969. Over the years the function of this committee has been to place Zambians in all positions vacated by Europeans or other nationals. Although the Zambians experience little difficulty in filling posts in the lower echelon, the Government was faced with a tremendous shortage of trained Zambians for the industry's managerial positions that required professional qualifications in mining, metallurgy, and geology. The Government's efforts are directed primarily to training Zambians at the University of Zambia which will have a full program by 1970.

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[1] Foreign mineral specialist, Bureau of Mines, Washington, D.C.

[2] Where necessary, values have been converted from the Zambian currency kwacha to U.S. dollars at the rate of K1.00=US$1.40.

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The survey of Tanzania-Zambia Railways, by the mainland Chinese was completed in 1969. Among the development expenditures contained in the Zambian 1970 budget was a provision of $140 million for Tan-Zam Railway. Estimated total cost of the construction is said to be about $186.2 million.

PRODUCTION

The approximate total value of all mineral production for the first 10 months of 1969 amounted to $852 million compared with $617 million during the corresponding period in 1968. Production of blister copper and electrolytic copper in 1969 reached a new high, exhibiting an increase of 12.7 percent and 12.3 percent, respectively, over 1968 production figures. Production of other mineral commodities in Zambia were relatively unimportant. Production of amethyst and phyllite increased 561 percent and 92 percent respectively in 1969, while cadmium production decreased almost 47 percent.

Table 1.—Zambia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Cadmium—kilograms	10,000	11,297	6,037
Cobalt, metal	1,455	1,197	1,798
Copper:			
Concentrate, copper content	60	36	-------
Blister	82,755	93,038	104,917
Electrolytic	616,844	572,063	642,576
Other	643	570	673
Gold [1] e—troy ounces	5,000	5,000	5,000
Lead, refined	19,101	21,893	23,000
Manganese ore	24,968	25,373	e 25,000
Selenium [2] e—kilograms	26,000	26,000	26,000
Silver [3] e—troy ounces	750,000	768,000	768,000
Zinc, electrolytic	44,484	53,138	50,155
NONMETALS			
Amethyst—kilograms	89,839	17,270	114,172
Cement—thousand tons	300	280	208
Gypsum	1,418	1,075	e 1,200
Lime	70,000	71,549	e 70,000
Limestone	578,206	644,833	772,291
Phyllite	25,461	32,890	63,093
Talc	-------	-------	2,290
MINERAL FUELS AND RELATED MATERIALS			
Coal	393,067	573,518	397,172

e Estimate.
[1] Chiefly contained in electrolytic copper, refinery muds, and blister copper.
[2] Contained in electrolytic copper, refinery muds, and blister copper.
[3] Refined silver and silver contained in electrolytic copper, refinery muds, and blister copper.

TRADE

The total value of exports from Zambia in 1968 was about $1,067 billion, of which copper contributed about $716 million and other mineral exports contributed approximately $22.1 million. The United Kingdom remained Zambia's principal trading partner, followed by Japan and West Germany.

The value of total imports in 1968 was $436.4 million. Of this, mineral commodities accounted for about $56.3 million or about $6.1 million more than in 1967. In spite of completion of the petroleum product pipeline, and production of indigenous coal, Zambia imported coal and petroleum products in 1968 valued at about $24.8 million.

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Table 2.—Zambia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Cadmium, metal	11	9
Cobalt, metal	2,091	1,227
Iron and steel:		
Scrap	NA	-------
Semimanufactures: Castings	-------	9
Lead:		
Bar and ingot	17,416	16,854
Sheet and bar	-------	283
Manganese, ore and concentrate	24,715	17,487
Silver, unworked troy ounces	166,000	76,097
Zinc, ingots and bars	39,811	45,026
Old and scrap metal, n.e.s.	813	108
NONMETALS		
Cement for building, including hydraulic lime	40	44
Lime	-------	65

NA Not available.

Table 3.—Zambia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum semimanufactures	374	518
Chromium ore and concentrate	862	814
Copper and copper alloys, all forms	476	533
Iron and steel:		
Iron ore and concentrate	36	37
Scrap	52	-------
Pig iron, sponge iron, and ferroalloys	2,837	1,254
Ingots and other primary forms	97	144
Semimanufactures	97,546	123,767
Lead and lead alloys	68	51
Tin and tin alloys long tons	1,452	44
Nonferrous ores and concentrates, n.e.s.	105	7
Nonferrous metal scrap	2	2
Other old and scrap metal	34	4
NONMETALS		
Abrasives:		
Grinding and polishing wheels	107	98
Industrial diamond carats	11,750	-------
Other, crude	2	3
Asbestos, crude, washed or ground	771	127
Cement:		
Building, including hydraulic lime	87,782	102,923
Clinker	50,642	25,174
Fire and furnace (including furnace mortar)	729	1,083
Clays:		
Fire clay	676	759
Cornish stone, kaolin, and china clay	888	1,299
Fertilizers	69,972	59,845
Gypsum and plaster of paris	2,916	21,687
Lime, building	282	142
Marble, granite and other monumental stone	106	1,489
Mica, blocks or sheets	-------	2
Salt	11,797	18,582
Sulfur, crude	2,882	401,293
MINERAL FUELS AND RELATED MATERIALS		
Coal and coal products:		
Coal and briquets	983,001	700,643
Coke	74,267	85,703
Pitch, tar and other coal products	125	215
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	803	809
Kerosine do	110	109
Jet fuel do	110	165
Distillate fuel oil do	1,039	1,322
Residual fuel oil do	302	214
Lubricating oils do	84	114
Greases, jellies and waxes	3,874	1,672
Asphalt and bitumen	20,706	16,137
Other 42-gallon barrels	3,014	4,323

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COMMODITY REVIEW

METALS

Copper.—Copper production soared to a new high of 747,400 metric tons in 1969 which was 82,000 tons more than in 1968, and approximately 62,000 tons above the record set in 1965. Despite expansion plans, production of copper is not likely to rise as much in 1970, since the high output in 1969 was due partly to companies cutting into the stockpile of concentrate accumulated while Zambia was solving fuel problems associated with Rhodesia's Unilateral Declaration of Independence.

In March 1969 the Anglo-American Corporation group announced that $14 million was earmarked for prospecting operations in Zambia over the next 7 years. One-half of this amount was to be spent on exploration work within the copperbelt area at the Kansanski mine, and the other half was to be spent for prospecting outside of the copperbelt area.

In July 1969, the Roan Selection Trust (RST) group announced the establishment of a new company, to be known as RST Industries Limited, whose object is to seek and develop new business projects in Zambia related to production and sale of copper and to agriculture.

During the latter half of 1969, the Mufulira mine was operating with only two reverberatory furnaces because each of the three furnaces was being closed down for 2 months for rebuilding and overhaul.

An increase in shipments, via the Tan-Zam Road, from a monthly average of 17,000 metric tons to 23,000 metric tons was achieved during the third quarter of 1969. It is the intention of the Government to utilize all four possible copper shipment routes—Tan-Zam Road, and the Mpanda, Lobito, and Rhodesian Railways —to the best advantage of the Government.

According to a press report in the Zambia Mail, preliminary work at the new copper mine on the Lunsemfwa River, about 70 miles southeast of Ndola, began in October 1969. The mine was expected to go into production in 14 months and will produce 2,000 tons of copper concentrate with a copper content of 30 percent each month. The concentrate will be refined at Rhokana mine through arrangements with the Anglo-American group. The mine has proven ore reserves of approximately one-half million tons, with an average grade of 2.5 percent copper.

Also, according to the same source, two Swiss firms, Florestina Immobilien A.G. and Aktien Invest A.G., are the owners of the mine through a Zambian subsidiary, Mkushi Mines, Ltd. When the mine is brought into production, at a cost of $10 million Indeco will acquire a 51-percent interest.

It was disclosed by the Government that the combined book value of the mining assets of RST and Anglo-American Corporation was to be calculated as of the last day of December 1969, and it was expected to be approximately $574 million. The Government's share of 51 percent would be about $292 million, representing $117 million for RST and $175 million for Anglo-American Corporation, and would be held through Indeco. Indeco was to issue bonds guaranteed by the Government which would bear interest at 6 percent.

It was also announced by the President of Zambia that the Nchanga, Rhokana, and Bancroft mines, together with Rhokana refinery, will form one operating unit to be named Nchanga Consolidated Copper Mines Limited, while the Mufulira, Luanshya, Chibuluma, Chambishi, and Kalengwa mines, along with the Ndola copper refinery, will form a second unit to be called Roan Consolidated Mines Limited. The existing mining groups were to be given management and subcontracts.

RST acquired the one-third interest of British Insulated Callender's Cables, Ltd. in Ndola Copper Refineries Ltd., which subsequently became a wholly owned subsidiary of RST. The assets and operations of Ndola Copper Refineries Ltd. were then transferred to Luanshya Mines, Ltd., also a wholly owned subsidiary of RST and the refinery company was placed in liquidation.

The four operating mines of the RST group (Mufulira, Chibuluma, Chambishi, and Luanshya) produced a record total of 333,979 tons of refined copper during the year, the highest in the history of the group.

The following ore reserve figures and grade of ore were given by officials of the RST group companies at the end of June 1969:

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Mine	Thousand metric tons	Copper, percent
Mufulira	145,431	3.28
Luanshya	69,604	2.87
Baluba	59,681	2.71
Chambishi	29,684	3.08
Chibuluma	5,763	5.12
Kalengwa	592	17.25
	204	8.5

Anglo-American's Rhokana smelter, which treats sulfide and some oxide concentrates from three mines, set the highest record in 37 years, by treating 27,600 metric tons in May 1969.

The major purchasers of Zambian copper in 1967 and 1968 by type and country were as follow:

Zambia: Exports of copper

(Metric tons)

	1967	1968	Principal destinations, 1968
Slimes	959	681	West Germany 491; Sweden 190.
Metal unwrought:			
Blister	78,806	90,630	Japan 39,730; West Germany 36,382; United Kingdom 10,437.
Electrolytic:			
Wire bar	450,818	504,701	United Kingdom 164,622; Japan 86,454; Italy 64,236; France 54,109.
Cathode form	69,044	40,267	United Kingdom 16,465; Japan 11,812; West Germany 4,803.
Ingot and bar	797	857	All to West Germany.
Sheet, plain	86	21	All to South Africa.

Iron and Steel.—Indeco was to invite bids from engineering concerns of 11 nations, including the United States, on a contract to build a $56-million iron and steel plant in Zambia. The iron ore for the plant will come from the Sanje deposits, 30 miles west of Lusaka, which have an estimated reserve of 33 million tons. Apparently the iron ore from these deposits, which was tested in Austria and Norway, has yielded satisfactory results. The site for the plant is said to be in the industrial complex south of Lusaka.

Lead-Zinc.—Combined production of lead and zinc metal in 1969 totaled 73,299 metric tons, compared with 75,122 metric tons in 1968. This decrease in production was attributed to a plant breakdown in December; however, further reductions in years ahead are expected as reserves of high-grade materials become exhausted.

NONMETALS

Cement.—The new $17-million Chilanga Cement Company's plant at Ndola was officially opened in August 1969. The plant, jointly owned by the Zambian Anglo-American group and Indeco, is designed for progressive expansion from the initial production level of 200,000 tons per year to approximately 800,000 tons annually. Once the plant is in full operation, the entire Zambian domestic demand for cement will be met.

Fertilizer.—It was announced that an agreement will soon be reached between the National Agricultural Marketing Board (NAMBA) and Nitrogen Chemicals Co. of Zambia, an Indeco subsidiary, whereby the company would assume (effective in 1970) the sole and exclusive right to import all fertilizer requirements into the country. NAMBA would be responsible for distribution to both the commercial and agricultural sectors.

MINERAL FUELS

Coal.—The efforts of the National Coal Board of Zambia (NCBZ) were showing results by yearend 1969. The chairman of NCBZ revealed that the new washing plant at the Maamba coalfields will be in operation by mid-1970 and possibly will be able to fulfill all domestic requirements. At the end of 1969 Zambia was importing more than 60 percent of the country's requirement of 1½ million tons of coal from Wankie Colliery in Southern Rhodesia. It is estimated that present reserves in Maamba alone are sufficient to sustain the country's demand for nearly 30 years. Other deposits have been tapped near Maamba and will be exploited as demand rises. The production level for Maamba de-

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posits is predicted at some 3 million tons of coal annually. As this would be in excess of the country's domestic requirement, the NCBZ was actively seeking export markets, with specific attention to the Congo which imports coal from Southern Rhodesia.

Petroleum.—With the completion of the 1,058-mile petroleum products pipeline from Dar es Salaam to the copperbelt, discussions were underway between the Government of Zambia and an Italian oil group to set up an oil refinery at Ndola. Tentative agreements call for erection of an oil refinery at a cost of approximately $34 million in which Indeco and Ente Nazionale Idrocarburi (ENI) will have equal shares. Apparently the refinery will be at Ndola, next to the present pipeline terminal. The initial annual production will be about 45 million gallons. The work is due to start in September 1970 and be completed by late 1972, at which time the product line from Dar es Salaam to Ndola will be utilized to transfer crude oil only.

Also, a marketing agreement was to be signed between Indeco and AGIP Zambia Ltd., a subsidiary of ENI, on an equal share basis to provide more pumps all over the country and compete with present facilities available in the country.

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The Mineral Industry of the Islands of the Caribbean

By Burton E. Ashley [1] and Gordon W. Koelling [2]

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ANTIGUA [3]

Natomas Co. of San Francisco, having acquired the minority interest in a subsidiary formerly held by Standard Oil Co. of Indiana, is now the sole owner of the West Indies Oil Co. West Indies planned to expand the capacity of its refinery at St. Johns from 10,000 to 15,000 barrels per day.[4]

Reported mineral production for 1968 amounted to 20,674 cubic meters of sand and 48,943 cubic meters of crushed and broken rock. Figures for 1969 were not available.

BAHAMAS [5]

The Bahamas Government announced the signing of a long-term contract with Ocean Industries, Ltd., a U.S. corporation, to produce, process, and market aragonite (calcium carbonate). Ocean Industries was reportedly a wholly owned subsidiary of the Dillingham Corp. of Hawaii. Base for the operation will be a "made" island about 20 miles south of Bimini, to be called Ocean Cay. The island of 200 acres will be the property of the Bahamian Government but under lease to the company for its operations. Ocean Cay will be built by dredging a 300-foot channel from the east end of the Grand Bahama bank.

Aragonite will be suction-dredged from the ocean floor, dewatered and held in two stockpiles of 140,000 tons each. Transportation of the aragonite to Flordia was to be by means of two self-propelled bulk carriers of 80,000 tons capacity each. Production of 2 million tons was projected for 1970.

Receiving and distribution facilities were planned at Fort Pierce, Fla. It was proposed that the distribution fleet would consist of two tugboats of 7,500 and 11,000 horsepower, which will tow barges of 25,000 and 40,000 tons, respectively. Two 80,000-bulk carriers were also planned to complete the fleet.

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[1] Physical scientist, Bureau of Mines, Washington, D.C.
[2] Geographer, Bureau of Mines, Washington, D.C.
[3] Prepared by Burton E. Ashley.
[4] Petroleum Press Service. V. 36. No. 11, November 1969, p. 435, and V. 36. No. 12, December 1969, p. 475.
[5] Prepared by Burton E. Ashley.

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Future plans called for other distribution terminals at Brunswick, Ga., Houston, Tex., and Philadelphia, Pa.

Estimated reserves of aragonite were put at about 50 billion tons, with annual world demand estimated at about 2 billion tons.

A paper [6] dealing with the carbonate geochemistry of the general area was published in 1969.

Reported mineral production in the Bahamas for 1969 was limited to slightly more than 500,000 tons of aragonite, 680,000 tons of salt, and 1,067,879 tons of limestone in various forms. Cement output was reported at 812,500 tons, compared with 682,200 tons during 1968.

[6] Goodell, H. G., and R. K. Garman. Carbonate Geochemistry of Superior Deep Test Well, Andros Island, Bahamas. Bulletin, Am. Assoc. of Petrol. Geol. V. 53. No. 3, March 1969, pp. 513–536.

Table 1.—Islands of the Caribbean: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
DOMINICAN REPUBLIC			
Bauxite, dry equivalent	983,043	994,338	1,093,465
Cement, thousand tons	310	328	391
Copper, mine output, metal content	33	105	477
Nickel, ferronickel, nickel content	34	294	NA
HAITI			
Bauxite, dried	359,192	445,664	664,923
Cement, thousand tons	40	41	e 40
Copper, mine output, metal content	2,350	1,597	1,797
Gold, mine output, metal content e, troy ounces	5,000	3,000	3,000
Silver, mine output, metal content e, do	34,000	17,000	17,000
JAMAICA			
Aluminum:			
Alumina, exports	837,787	922,888	1,155,312
Bauxite, dry equivalent of crude ore	9,267,692	8,525,488	10,498,631
Cement, thousand tons	335	409	416
Clays e, do	126	140	272
Gravel e, thousand cubic meters	248	274	68
Gypsum	167	209	272
Iron and steel, semimanufactures	---	10,047	19,305
Petroleum refinery products:			
Gasoline, thousand 42-gallon barrels	1,542	1,017	1,988
Kerosine and jet fuel, do	819	971	1,335
Distillate fuel oil, do	4,647	1,692	2,204
Residual fuel oil, do		4,139	5,103
Liquefied petroleum gas, do	NA	113	166
Asphalt, do	NA	92	135
Other, do	356	NA	---
Sand:			
Common e, thousand cubic meters	765	841	904
For glass	e 8,700	e 8,900	12,061
MARTINIQUE			
Clays	46,000	57,000	50,000
Pumice	15,000	14,970	18,000
Salt, cubic meters	120,000	---	150,000
Stone, sand, and gravel:			
Crushed and broken	570,598	592,284	644,768
Sand	220,000	302,285	46,228
Other [1]	225,400	157,500	159,190
NETHERLANDS ANTILLES			
Fertilizer materials:			
Phosphate rock, crude, thousand tons	116	93	e 80
Nitrogenous, manufactured, sales, do	144	207	e 220
Petroleum refinery products:			
Gasoline and naphthas, thousand 42-gallon barrels	r 44,257	33,775	41,655
Kerosine and jet fuel, do	r 25,607	33,985	41,325
Distillate fuel oil, do	r 34,127	29,604	27,532
Residual fuel oil, do	r 157,473	156,444	170,716
Lubricants, including greases, do	r 3,442	6,972	6,774
Other	r 24,249	20,786	6,940
TRINIDAD AND TOBAGO			
Argillite, thousand cubic meters	115	92	79
Asphalt, natural, thousand tons	145	139	124
Cement, do	190	NA	243
Clays, thousand cubic meters	74	59	62
Fertilizer materials, manufactured, nitrogenous, thousand tons	530	585	624
Gas:			
Natural, gross production, million cubic feet	140,338	151,445	137,503
Natural gas liquids, thousand 42-gallon barrels	183	164	158
Gypsum	3,647	4,318	2,072

See footnotes at end of table.

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Table 1.—Islands of the Caribbean: Production of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
TRINIDAD AND TOBAGO—Continued				
Petroleum:				
Crude	thousand 42-gallon barrels	64,995	66,904	57,429
Refinery products:				
Gasoline:				
Aviation	do	1,746	519	478
Motor, including naphtha	do	19,524	20,850	21,704
Kerosine and jet fuel	do	15,331	19,083	17,452
Distillate fuel oil	do	19,191	18,068	17,018
Residual fuel oil	do	75,496	85,337	88,381
Liquefied petroleum gases	do	312	365	423
Lubricants	do	1,233	1,094	1,466
Asphalt	do	274	199	192
Other	do	1,660	1,562	1,717
Sand, pitch	thousand cubic meters	10	10	28
Stone, sand, and gravel:				
Limestone	do	435	465	266
Porcellanite	do	18	6	43
Sand and gravel	do	189	187	190
Sulfur, byproduct		1,865	3,359	4,801

e Estimate. p Preliminary. r Revised. NA Not available.
[1] Includes volcanic tuff and materials used for fill, ballast, and other purposes.

BARBADOS [r]

General Crude Oil Co. of Houston was granted a 1-year extension from July 1969 to explore for oil in Barbados and offshore waters. General Crude will pay a rental of 25 cents an acre for onshore exploration rights; no payment was required for offshore rights.

Natural gas production in 1969 was reported at 108.3 million cubic feet, compared with 96.7 million cubic feet in 1968.

Petroleum refinery production is tabulated as follows, in thousand 42-gallon barrels:

Product	1967	1968	1969 p
Gasoline	157	226	246
Kerosine	103	101	105
Distillate fuel oil	246	234	333
Residual fuel oil	141	149	169
Asphalt	33	36	35

p Preliminary.

Foreign trade figures for 1968 were not available for publication, but statistics for 1967, in tables 2 and 3, give a measure of typical trade volume.

[r] Prepared by Burton E. Ashley.

Table 2.—Barbados: Exports and reexports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967
METALS		
Iron and steel:		
Scrap		22
Semimanufactures		868
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, excluding briquets		19
Gas, hydrocarbon, manufactured		16
Petroleum refinery products:		
Gasoline	thousand 42-gallon barrels	511
Kerosine	do	112
Distillate fuel oil	do	558
Residual fuel oil	do	1,123

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Table 3.—Barbados: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967
METALS		
Aluminum, including alloys, all forms		119
Iron and steel:		
Pig iron, ferroalloys, and similar materials		16
Steel, primary forms		103
Semimanufactures		7,923
Castings and forgings		25
Lead, including alloys, all forms		153
Tin, including alloys, all forms	long tons	457
NONMETALS		
Asbestos		385
Cement		34,281
Fertilizer materials, manufactured		19,532
Salt		2,127
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets		597
Coke		52
Gas, hydrocarbon, manufactured		1,556
Petroleum:		
Crude	thousand 42-gallon barrels	704
Refinery products:		
Gasoline	do	24
Kerosine and jet fuel	do	113
Distillate fuel oil	do	551
Residual fuel oil	do	1,046
Lubricants	do	11
Mineral tar and other coal, petroleum, and crude chemicals		14

Source: Government of Barbados, Statistical Service, Overseas Trade, 1967, 346 pp.

BERMUDA [8]

Bermuda's small mining industry is limited to output of construction materials such as sand and limestone. Reliable production statistics are not available and probably are not recorded officially.

Table 4 shows foreign trade in selected mineral commodities for 1967 and 1968.

[8] Prepared by Burton E. Ashley.

Table 4.—Bermuda: Foreign trade of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
EXPORTS AND REEXPORTS			
Petroleum refinery products:			
Gasoline:			
Aviation	thousand 42-gallon barrels	r 58	131
Other	do	r 759	873
Kerosine	do	1	1
Jet fuel	do	r 673	606
Residual fuel oil (bunkers)	do	139	145
Scrap, metal, unspecified	value	US$73,714	US$128,762
IMPORTS			
Cement:			
Portland		22,796	12,259
Other		1,600	5,943
Fertilizers		962	1,036
Petroleum refinery products:			
Asphalt	thousand 42-gallon barrels	14	18
Gasoline	do	r 289	196
Jet fuel	do	r 364	780
Kerosine	do	227	108
Distillate fuel oil	do	r 899	324
Residual fuel oil	do	r 226	178
Lubricating oil	do	r 8	8
Salt		183	166

r Revised.

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CUBA [9]

No firsthand information concerning the mineral industry of Cuba was available to the Bureau of Mines during the year.

Trade journals announced that Cuba planned to expand nickel output to around 240 million pounds a year. A new nickel oxide facility was being considered for construction at Punta Gorda,[10] about 75 kilometers east of the present plant at Moa Bay. Capacity of the new plant was put at 30,000 tons annually, using the ammonia leaching process. This would not contribute to cobalt as cobalt is not recovered in this particular process. French, Italian, and British sources were named as possible contributors of financial and technical assistance.

Cuban sources announced that Cuba's nickel reserves were on the order of 16 million to 18 million metric tons, or about 40 percent of the known world supply. It was not stated whether this latter figure took into consideration recent Australian discoveries.

Bureau of Mines estimates for nickel and cobalt output for the last 3 years were as follows, in metric tons, and revised from previous estimates as noted:

	Nickel	Cobalt
1967	r 30,900	1,045
1968	r 33,700	r 1,300
1969	35,450	1,540

r Revised.

Tables 5 and 6 show selected mineral trade between Cuba and Poland, and Cuba and the U.S.S.R., for 1967 and 1968.

[9] Prepared by Burton E. Ashley.
[10] Mining Journal (London). V. 274, No. 7017, Feb. 13, 1970, p. 134.

Table 5.—Cuba: Selected mineral commodity trade with Poland

(Metric tons)

Commodity	1967	1968
EXPORTS TO POLAND		
Chrome ore	24,905	17,475
Copper concentrate	2,525	1,481
Manganese ore	37,989	22,000
Other nonferrous concentrate	337	332
IMPORTS FROM POLAND		
Steel semimanufactures	490	511
Cement	19,730	------
Coke	8,000	------
Petroleum products	1,331	1,261

Source: Rocznik Statystyczny Handlu Zagranicznego (Foreign Trade Statistical Yearbook), 1968. Warsaw, 1969, 430 pp.

Table 6.—Cuba: Selected mineral commodity imports from U.S.S.R.

(Metric tons)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, all forms	4,900	4,500
Copper, metal, including alloys, all forms	4,500	5,700
Iron and steel, metal:		
Pig iron	60,200	45,600
Ferroalloys	1,300	2,100
Steel semimanufactures:		
Tinned plates and sheets	24,800	19,200
Tubes and pipe	28,000	30,500
Other rolled products	126,500	126,000
Lead, metal, including alloys, all forms	900	1,000
Zinc, metal, including alloys, all forms	600	300
NONMETALS		
Asbestos	9,900	9,700
Cement	257,000	274,000
Fertilizer materials:		
Nitrogenous	416,800	287,500
Phosphatic	115,800	115,300
Potassic	91,700	97,900
Refractory materials	12,400	12,100
Sulfur	135,500	97,600
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	3,800	3,500
Coke, thousand tons	39	32
Petroleum, crude oil, and refinery products, do	5,297	5,303

Source: Vneshnyaya Torgovlya S.S.S.R. za 1968 god (Foreign Trade of the U.S.S.R. for 1968).

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DOMINICAN REPUBLIC [11]

Production and development work on bauxite, copper, and nickel progressed during the year.

Two companies reportedly were active in exploration for copper and nickel. Radio Hill Mines Co., Ltd., purchased the controlling shares in the concession held by Pinar Bonito Copper Corp. This property was previously appraised by Japanese interests. Further prospecting work is being undertaken.

Dominican Ventures, Inc. (incorporated in Delaware), reportedly planned to invest an additional $250,000 in an exploration program, after having spent about $100,000 in preliminary work. Primary objectives were to be directed toward development of copper and nickel prospects.

Minerales Industriales, C. por A., largely owned by American interests, reportedly held exploration rights over a million hectares of land. Two copper prospects, one near Constanza and the other near San Cristobal, may be developed when the Government grants approval.

New York and Honduras Rosario Mining Co. acquired a one-third interest, and operating responsibilities, over the Pueblo Viejo gold-zinc property. If the exploration program in progress warrants development, an open pit mine will be developed. A decision was expected by mid-1970.

Falconbridge Dominicana, C. por A. (Falcondo), completed financing arrangements for its $195 million ferronickel plant. The International Bank for Reconstruction and Development, in its first loan made in the Dominican Republic, supplied $25 million to help finance a 198-megawatt thermal electric generating station, a 44-mile pipeline to transport oil from the port of Haina to the powerplant, associated installations at the ferronickel plant, and water treatment facilities. Other financing was to be obtained from U.S. insurance companies, U.S. and Canadian banks, and various commercial banks.

The metallurgical plant site work and construction were in progress at yearend, and bids had been called for specialized control equipment. Ferronickel production at the rate of 63.4 million pounds annually was scheduled for 1972.

Falconbridge Nickel Mines, Ltd., holds a 66-percent interest in Falcondo, with Armco Steel Corp. and the Government of the Dominican Republic holding lesser shares in the enterprise.

Producto Diversos, C. por A., began operation of its galvanizing plant in August; uncoated iron sheets from Japan supplied stock for the plant. Production of finished products was reported at 800 tons per month.

A second galvanizing plant to be held by local interests was also reportedly under consideration. If constructed, total output of both plants would be about 1,600 tons monthly, to supply present demand for 1,200 tons a month. Lower costs of locally galvanized sheets could create demand for enough of the product to sustain both enterprises.

Shell International Petroleum Co. (rather than Midland Coqperatives, Inc.,) signed a contract on November 7 to build the Dominican Republic's first petroleum refinery. The plant, costing $30 million and scheduled to begin production early in 1972, was to be located at Nigua, about 20 kilometers west of Santo Domingo. The refinery operating company, Cía. Dominicana Refinadora de Petróleo, S.A. (Codorepsa), will initially be owned jointly by Shell and the Government. After the refinery becomes operational, Shell will offer part of its shares to other distributors of petroleum products within the country.

Initial capacity was planned for 30,000 barrels daily; products are to be gasoline, kerosine, liquid gas, and fuel oil.

Bauxite exports in 1967 amounted to 1,243,342 tons; 1968 figures were not available. Other mineral exports of significant volume in 1967 were cement—10,142 tons and gypsum—85,431 tons. As 1968 foreign trade figures were not available for publication, table 7 presents imports for 1967.

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[11] Prepared by Burton E. Ashley.

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Table 7.—Dominican Republic: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967
METALS		
Copper, metal, including alloys, semimanufactures		832
Gold, silver, platinum, metal, unworked or partly worked	troy ounces	191,072
Iron and steel, metal, semimanufactures		50,960
NONMETALS		
Cement		3,805
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets		321
Petroleum, refinery products:		
Gasoline	thousand 42-gallon barrels	1,517
Kerosine	do.	267
Distillate fuel oil	do.	755
Residual fuel oil	do.	1,469
Lubricants	do.	44
Other	do.	208

Source: Oficina Nacional de Estadística, Comercio Exterior de la República Dominicana (National Office of Statistics, Foreign Trade of the Dominican Republic). V. 15, 1967. Santo Domingo, 1968, 308 pp.

GRENADA [12]

It was reported that the Government of Grenada granted an oil exploration license to Western Transmission Corp. of New York City for rights over Grenada's offshore territory. Consideration was said to be $50,000, but no term for the license was indicated.

In 1968, mineral commodity output was limited to 34,365 cubic meters of sand and gravel and 23,363 cubic meters of crushed and broken quarry products; output for 1969 was reported at 19,267 cubic meters of sand and gravel and 59,558 cubic meters of crushed and broken quarry products.

HAITI [13]

Consolidated Halliwell, Ltd., carried on exploration efforts at its copper mine near Mémé. Copper values, which might indicate a new ore body, were intersected in two holes drilled from the 1,700-foot level. It was expected that the present exploration program would be completed in March 1971.

Ore reserves at the mine at yearend were said to be 346,660 tons grading 1.44 percent copper, with a small amount of recoverable gold.

Sheraton Mining Corp. acquired a 3,360-acre copper prospect from Haicana Mining Corp., S.A. The property is located 24 miles southeast of Cap Haitien. Haicana Corp. held concession rights over 580 square miles in the area.

Sheraton planned a drilling program of some 5,000 feet of hole. Initial work on the prospect indicated favorable copper values.

Haicana Corp. was reportedly formed by Canadian, Haitian, and American interests. Its large concession centers on the town of Plaisance; terms of the concession were for 25 years, with a 25-year extension possible. The area lies northeast of the copper mine operated by Consolidated Halliwell.

JAMAICA [14]

The bauxite and alumina industry in Jamaica made gains during the year with new operations being recorded in alumina production. The tax on exported bauxite was raised from $1.54 to $2 per ton. The original agreement for the increase was made between Alcoa Minerals of Jamaica, Inc., and the Government. Negotiations were continuing with other bauxite exporters.

Alumina Partners of Jamaica, Ltd. (Alpart), started production in May, with the first shipment of alumina following in early August. Alpart is held by The Anaconda Co. (36.8 percent), Reynolds Metals

[12] Prepared by Burton E. Ashley.
[13] Prepared by Burton E. Ashley.
[14] Prepared by Burton E. Ashley.

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Co. (36.8 percent), and Kaiser Aluminum and Chemical Co. (26.4 percent). Costing more than $20 million, the alumina plant was said to have the highest initial capacity, at 950,000 tons annually, of any such facility thus far constructed worldwide.

Shipments for export were made from the plant at Nain, St. Elizabeth parish, to Port Kaiser, by means of Alpart's own railway.

Construction was progressing on the alumina plant being built for Revere Jamaica Alumina, Ltd.; completion was scheduled for March 1971.

Some exploration for copper and petroleum was in progress at yearend.

Bellas Gates Copper Mines was drilling a copper prospect and confirmed low-grade copper mineralization of potential economic interest in the early phase of the program. Financial support for the work was being afforded by Canadian and Japanese interests.[15]

Signal Oil and Gas Co. and Occidental Petroleum Corp. signed an agreement under which Occidental will be able to earn a 50-percent interest involving 6.5 million acres held by Signal. The acreage lies both offshore and onshore of Jamaica and Honduras. Occidental will conduct an exploration and drilling program to acquire its interest.

Complete foreign trade statistics relating to 1968 were not available for publication. Table 8 presents the more significant mineral commodities traded in 1967 and 1968.

[15] Mining Magazine. V. 121, No. 6, December 1969, p. 495.

Table 8.—Jamaica: Foreign trade of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
EXPORTS			
Alumina		r 837,767	922,388
Bauxite		r 7,257,052	6,311,756
Cement		77,238	92,566
Gypsum		191,724	253,328
Petroleum, refinery products:			
Gasoline	thousand 42-gallon barrels	491	271
Kerosine	do	77	34
Distillate fuel oil	do	r 672	318
Residual fuel oil	do	r 126	332
Lubricants	do	76	• 15
Other	do	81	---
IMPORTS			
Aluminum, all forms		4,475	2,379
Copper, all forms		284	346
Iron and steel, all forms		85,120	84,855
Petroleum:			
Crude	thousand 42-gallon barrels	r 6,776	8,557
Refinery products:			
Gasoline	do	788	134
Kerosine	do	274	311
Distillate fuel oil	do	511	743
Residual fuel oil	do	2,585	1,774
Lubricants	do	118	55
Other	do	43	35

• Estimate. r Revised.

MARTINIQUE [16]

It was announced that the fertilizer complex being built by the Sun Oil Co. will be operated by Société Antillaise de Produits Chimiques (Saprochim). Sun will hold an 80-percent interest, with the balance held by residents of Martinique and Guadeloupe.

The facility is to include plants for the manufacture of ammonium nitrate and nitric acid. Raw materials will be imported. It was planned that the entire output of granulated fertilizer would be distributed among the Caribbean Island community for use chiefly with such crops as sugarcane, bananas, and pineapples.[17]

A cement plant was also scheduled for construction.

[16] Prepared by Burton E. Ashley.
[17] Phosphorus and Potassium. No. 45, January–February 1970. p. 7.

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NETHERLANDS ANTILLES [18]

Mineral industry activities in the Netherlands Antilles continued to be confirmed primarily to petroleum refining during 1969.

At yearend, an expansion project was in progress at the Shell Curaçao N.V. refinery at Emmastad. This involved a 30,000-barrel-per-day increase in the plant's crude oil distillation capacity and the expansion of its vacuum distillation capacity by 18,000 barrels per day. A 36,000-barrel-per-day fuel oil hydrotreater was also being added. Completion of the project was scheduled for 1970.

Lago Oil and Transport Co., a subsidary of Standard Oil Co. (New Jersey), was forced to abandon its plan to use Venezuelan natural gas as the source of hydrogen for a hydrodesulfurization unit to be constructed at its Aruba refinery when the Venezuelan Government announced during 1969 that it would not approve the construction of an underwater gas pipeline from Amuay, Venezuela, to Aruba. As a result, refinery pentanes are to be used as the hydrogen source for desulfurization. The Aruba desulfurization unit is to have an output capacity of 75,000 barrels per day of residual fuel oil with a 1-percent sulfur content. Completion of the unit is expected by late 1971.

The Netherlands Antilles' only operating phosphate mine was closed from early August to mid-September 1969 as a result of a wildcat strike. International Salt Co. reported during the latter part of the year that it expected to begin exporting salt from its salt-recovery complex on Bonaire sometime during 1970. Aruba Chemical Industries, N.V., a subsidary of Standard Oil Co. (New Jersey), was in the process of increasing the capacity of its petrochemicals plant at yearend 1969.

[18] Prepared by Gordon W. Koelling.

Table 9.—Netherlands Antilles: Selected exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Iron and steel, metal, scrap and other		27	4,975
Other nonferrous metals, ores, and concentrates		r 2,002	814
NONMETALS			
Fertilizer materials:			
Crude, phosphatic		118,338	93,188
Manufactured:			
Nitrogenous		125,759	145,225
Other, including mixed		5,520	805
Stone, sand, and gravel		13,228	31,811
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets		267	88
Petroleum:			
Crude	thousand 42-gallon barrels	8,755	2,019
Refinery products:			
Gasoline	do.	37,691	33,435
Kerosine	do.	4,638	5,705
Jet fuel	do.	34,871	33,916
Distillate fuel oil	do.	32,273	27,057
Residual fuel oil	do.	133,657	139,857
Lubricants	do.	7,082	6,934
Mineral jelly and wax	do.	214	258
Bitumen and other residues	do.	6,201	6,701
Other	do.	r 243	296

r Revised.

Source: Kwartaalstatistiek van de In- en Uitvoer per Goederensoort van Curaçao en Aruba, (Statistical Quarterly of Import and Export Commodities of Curaçao and Aruba). 1967, No. 4, and Jaarstatistiek van de In- en Uitvoer per Goederensoort van de Nederlandse Antillen, Bureau Voor de Statistiek (Annual Statistical Report of Import and Export Commodities of the Netherlands Antilles published by the Bureau of Statistics). 1968.

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Table 10.—Netherlands Antilles: Selected imports of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, all forms	303	138
Copper, metal, including alloys, all forms	214	343
Iron and steel, semimanufactures	14,010	10,051
Lead, metal, including alloys, all forms	69	61
Zinc, metal, including alloys, all forms	181	78
Other, nonferrous metal, scrap	362	73
NONMETALS		
Cement	36,475	45,908
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s., fire clay	7,250	5,591
Products, refractory brick	1,677	1,057
Diamond, gem, not set or strung ..... carats	1,450	2,440
Fertilizer materials:		
Crude	4,000	2
Manufactured	3,542	1,128
Gypsum and plasters	35	35
Lime	265	221
Precious and semiprecious stone, except diamond ..... kilograms	9	20
Salt	1,107	1,005
Sodium compounds	22,430	15,375
Stone, sand, and gravel	7,320	11,091
MINERAL FUELS AND RELATED MATERIALS		
Gas, hydrocarbon, liquefied petroleum gas ..... thousand 42-gallon barrels	472	354
Petroleum:		
Crude ..... do	260,624	253,636
Refinery products:		
Gasoline ..... do	4,841	2,685
Kerosine and jet fuel ..... do	1,221	1,466
Distillate fuel oil ..... do	r3,597	1,142
Residual fuel oil ..... do	r8,693	13,059
Lubricants	170	90
Other	4	3
Mineral tar and other coal, petroleum, or gas derived crude chemicals	27	39

r Revised.
Source: Kwartaalstatistiek van de In- en Uitvoer per Goederensoort van Curaçao en Aruba (Statistical Quarterly of Import and Export Commodities of Curaçao and Aruba). 1967, No. 4; and Jaarstatistiek van de In- en Uitvoer per Goederensoort van de Nederlandse Antillen, Bureau Voor de Statistiek (Annual Statistical Report of Import and Export Commodities of the Netherlands Antilles published by the Bureau of Statistics), 1968.

ST. VINCENT [19]

Four firms reportedly applied for oil exploration rights in the territorial waters of St. Vincent and the Grenadines. The firms were not identified with the possible exception of General Crude Oil Co. of Houston.

In 1968, mineral production amounted to 30,582 tons of sand and 25,001 tons of crushed stone. Figures for 1969 output were not available.

TRINIDAD AND TOBAGO [20]

Substantial offshore discoveries of crude oil and natural gas, the advent of direct Government participation in the petroleum industry, and the enactment of new petroleum legislation highlighted mineral industry activities in Trinidad and Tobago during 1969.

The most important new discoveries were made by AMOCO Trinidad Oil Co., a subsidary of Standard Oil. (Indiana), which found significant quantities of crude oil in two wells off the east coast of Trinidad in the same general area where sizable quantities of nonassociated natural gas were also discovered by AMOCO during the year. One of these wells flowed at rates of 800 to 2,500 barrels per day during drill stem tests of short duration at eight different intervals between 5,000 and 7,000 feet. In production tests at the other oil discovery well, the rate of flow from a 4-foot vertical section of the hole below 11,000 feet ranged from 1,000 to 1,400 barrels per day. Crude oil from the latter well was reportedly free of sulfur.

Crude oil was also discovered in a well drilled off Trinidad's west coast by Belpetco Trinidad, Ltd., a subsidary of Belco Petroleum Corp. This well flowed at the rate of 500 barrels per day from a depth of 6,500 feet when tested.

Results of a joint Government-United

[19] Prepared by Burton E. Ashley.
[20] Prepared by Gordon W. Koelling.

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Nations seismic survey covering an 8,800-square-kilometer area off Trinidad's north coast were released to 27 oil companies in mid-1970. These companies, which were charged a fee for this data, were expected to submit bids by the end of February 1970 for exploration and production licences in the survey area.

In July 1969, the Government purchased the petroleum rights and producing properties of BP Trinidad, Ltd. The Trinidad-Tesoro Petroleum Co., Ltd., owned equally by the Government and the Tesoro Oil Co. of San Antonio, Tex. was established to operate the acquired assets. Later in the year, Trinidad-Tesoro also acquired an oil and gas development farmout covering approximately 195,000 hectares located off Trinidad's southeast coast from Dominion Oil, Ltd., a subsidary of Standard Oil Co. of California.

In December 1969, the Parliament of Trinidad and Tobago approved a new Petroleum Act which had been submitted by the Government following prolonged discussions with the oil companies. All existing licenses and leases will be relicensed under the Act but will not be changed with respect to duration, renewal, and royalty rights. Major new features of the Act include the requirement of Governmental licenses for all phases of petroleum industry activity and the stipulation that local refinery operators must give precedence to the processing of indigenous crude oil. In addition, prices of crude oil, natural gas, petroleum products, and petrochemicals for income tax purposes will be determined by the Government after consultation with the oil companies.

The Continental Shelf Act, approved during late 1969, is designed to regulate minerals exploration and exploitation on the Continental Shelf of Trinidad and Tobago and to carry out that country's obligations under the 1958 Convention on the High Seas. This Act specifically subjects mineral industry operations adjacent to the coast of Trinidad and Tobago but outside its territorial waters (12-mile limit) to the tax and mineral laws of the country.

Table 11.—Trinidad and Tobago: Selected exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, all forms	117	69
Copper, metal, including alloys, all forms	824	400
Iron and steel:		
Scrap	2,938	477
Semimanufactures:		
Bars, rods, angles, shapes, and sections	176	89
Plates and sheets, all types	426	593
Other	480	198
Lead, metal, including alloys, all forms	59	69
Silver, metal, including alloys, all forms—troy ounces	-------	8,837
Tin, metal, including alloys, all forms—long tons	454	92
NONMETALS		
Barite and witherite	305	2
Clays and clay products (including all refractory brick)	r 1,198	287
Fertilizer materials, manufactured:		
Nitrogenous	109,960	104,035
Other	6	37
Lime	2,161	8,066
Salt	5	95
Stone, sand, and gravel	279	151
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	60,235	55,086
Gas, hydrocarbon, natural gas liquids	17,650	21,198
Petroleum:		
Crude and partly refined [1]—thousand 42-gallon barrels	5,801	6,983
Refinery products:		
Gasoline—do	15,406	20,150
Kerosine—do	56	2,667
Jet fuel—do	11,502	15,787
Distillate fuel oil—do	18,938	16,579
Residual fuel oil—do	77,807	76,725
Lubricants—do	1,018	1,248
Other—do	412	1,937
Mineral tar and other coal, petroleum, or gas derived crude chemicals	218,186	190,959

r Revised.

[1] Government of Trinidad and Tobago, Ministry of Petroleum and Mines.

Source: Government of Trinidad and Tobago, Central Statistical Office, Overseas Trade, Part A. Port of Spain, 1967, 405 pp.; 1968, 433 pp.

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Table 12.—Trinidad and Tobago: Selected imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, all forms	784	434
Arsenic compounds	89	12
Copper:		
Ore and concentrate	1	17
Copper sulfate	28	28
Metal, including alloys, all forms	115	115
Iron and steel:		
Scrap	221	246
Steel, primary forms, ingots	640	1,023
Semimanufactures:		
Bars, rods, angles, shapes, and sections	r 12,502	15,270
Universals, plates, and sheets	14,771	8,986
Tubes, pipes, and fittings	21,137	24,689
Other	159	140
Lead:		
Ore and concentrate	------	245
Metal, including alloys, all forms	139	193
Silver, metal, including alloys, all forms, troy ounces	27,922	51,035
Tin, metal, including alloys, all forms, long tons	6,584	4,417
Zinc, metal, including alloys, all forms	24	26
NONMETALS		
Abrasives, natural	r 15	22
Barite and witherite	44,739	28,706
Cement	3,004	4,043
Clays and clay products (including all refractory brick):		
Crude clays	774	617
Products:		
Refractory, including nonclay bricks	896	561
Nonrefractory	21	224
Feldspar	30	30
Fertilizer materials:		
Crude	r 44	16
Manufactured:		
Nitrogenous	r 989	179
Phosphatic	589	2,333
Potassic	1,585	2,741
Other, including mixed	2,228	1,370
Magnesite	77	100
Mica, all forms	25	27
Precious and semiprecious stone, except diamond, troy ounces	618	705
Salt	9,230	10,706
Sodium and potassium compounds, n.e.s	5,068	5,576
Stone, sand, and gravel:		
Dimension stone	r 29	19
Gravel and crushed rock	7,802	8,618
Sand	16	13
Sulfur	14,704	44,788
Other nonmetals, n.e.s	1,195	625
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	25	57
Coal and coke	392	190
Gas, hydrocarbon, natural gas liquids	76	127
Petroleum:		
Crude and partly refined, thousand 42-gallon barrels	81,726	91,447
Refinery products:		
Gasoline, do	r 590	138
Residual fuel oil, do	531	61
Lubricants, do	r 28	33
Mineral jelly and wax, do	r 5	5
Other, do	r 3	1
Mineral tar and other coal, petroleum, or gas derived crude chemicals	139	199

r Revised.

Source: Government of Trinidad and Tobago, Central Statistical Office, Overseas Trade, Part A. Port of Spain, 1967, 405 pp.; 1968, 433 pp.

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The Mineral Industry of Central American Areas

By Burton E. Ashley [1]

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BRITISH HONDURAS

No reports of mineral or mining development were noted from British Honduras during 1969.

Foreign trade data for 1968 were not available for publication, but 1967 figures in table 1 indicate the normal order of magnitude for such trade. Exports and reexports are usually limited to small quantities of scrap metal, salt, cement, and petroleum products.

Table 1.—British Honduras: Foreign trade of selected mineral commodities

(Metric tons unless otherwise specified)

Imports		1967
Cement and lime		9,797
Fertilizers, manufactured		2,067
Iron and steel, semimanufactures		1,906
Petroleum, crude and refined	thousand 42-gallon barrels	218

COSTA RICA

No significant mineral production enterprises came to fruition in Costa Rica during 1969.

Of general interest to the industry were plans to increase the electric power supply of the country, to renew and add to the rolling stock and other equipment of the Pacific Railway Company, and to improve loading facilities at Puntarenas. The Government also reached agreement with the Northern Railway Company for operation of the piers at Puerto Limón, to be under Government control in the future. Railway rehabilitation was to be financed from internal sources.

Alcoa de Costa Rica, Inc., negotiated a supplemental contract with the Government which apparently gave the country some added benefits without seriously affecting the economics of the bauxite-alumina project. Assembly approval was expected. Status of actual work on the project was not known by yearend.

Consolidated Negus Mines, Ltd., granted an option to Thermocam Industries (British Columbia), Ltd., to work the La Fortuna and El Cedral sulfur deposits in Guanacaste Province. La Fortuna reportedly had indicated reserves of 750,000 tons of 29.9 percent sulfur ore. Thermocam believed that it could process the ore so that the contained pyrite could be eliminated economically.

[1] Physical scientist, Bureau of Mines, Washington, D.C.

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Gulf Oil Corp. withdrew from negotiations to buy Allied Chemical Corp.'s controlling shares in Refinadora Costarricense de Petróleo S.A. the domestic oil refinery.

Table 2.—Costa Rica: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
EXPORTS		
Fertilizer materials: Manufactured:		
Nitrogenous	11,834	21,677
Phosphatic	69	------
Other, including mixed	18,913	30,576
Iron and steel, metal, including alloys, all forms	7,558	10,813
IMPORTS		
Aluminum, metal, including alloys, all forms	843	1,146
Cement	2,958	2,152
Diamond, industrial ---carats	r 90,000	125,000
Fertilizer materials: Manufactured:		
Nitrogenous	28,510	56,448
Phosphatic	15,144	20,295
Potassic	19,031	22,952
Other, including mixed	26,886	19,824
Gypsum and plasters	4,493	6,489
Iron and steel: Metal:		
Scrap	13	22
Steel, primary forms	9,500	15,687
Semimanufactures	46,369	55,476
Petroleum:		
Crude and partly refined ---thousand 42-gallon barrels	795	2,039
Refinery products:		
Gasoline ---do	378	170
Kerosine ---do	117	65
Distillate fuel oil ---do	728	203
Lubricants ---do	76	82
Mineral jelly and wax ---do	r 15	14
Other, bitumen and other residues	10,532	8,967
Platinum-group metals and silver: Metals, including alloys:		
Platinum group ---troy ounces	5,691	932
Silver ---do	12,925	18,551
Salt (including brines)	4,165	4,105

r Revised.

Source: Ministerio de Indústria y Comercio, Dirección General de Estadística y Censos. Comércio Exterior de Costa Rica, San José, Costa Rica, 1967, 421 pp.; 1968, 428 pp.

EL SALVADOR

Little activity was noted in the mineral industry of El Salvador during 1969.

The Legislative Assembly approved a bill to establish a national mining reserve in connection with work to be done with assistance from United Nations advisers. The reserve covered all, or parts of, the Provinces of Morazán Cabañas Chalatenango, La Union San Miguel, Usuetám San Vicente, San Salvador, and Cuzcatlán. It was reported that the Government of El Salvador intended to develop any gold, silver, and iron resources itself.

The Ministry of Public Works reported that the Government continued its geochemical and geological investigations in the northern part of the country and made a final examination of the proposed new mining code. The survey covered 10,000 square kilometers; over 8,000 samples were taken, and more than 15,000 analyses were made. Examination was also made of sulfur deposits in the Ahuachapán area in the western part of the country.

Canadian Javelin, Ltd., operating through its subsidiary, Cía. Minera San Cristobal, S.A., reportedly was to reactivate the old Montecristo gold and silver mine

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in the Department of Morazán. Operations were scheduled to commence in early 1970, after the installation of equipment valued at $1.2 million.

Foreign trade statistics for 1967 and 1968 are shown in table 3.

Table 3.—El Salvador: Foreign trade of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968
EXPORTS		
Cement	14,620	45,538
Fertilizer materials, manufactured	24,119	32,570
Iron and steel, metal	12,451	19,404
Petroleum, refinery products, thousand 42-gallon barrels	1,587	767
Salt	8,564	9,124
IMPORTS		
Aluminum, metal, including alloys	2,164	2,088
Asphalt and bitumen, natural	7,478	6,508
Cement	37,316	39,879
Coal and coke, including briquets	285	311
Diamond, industrial, carats	25,000	20,000
Fertilizer materials: Manufactured:		
Nitrogenous	70,849	93,778
Phosphatic	16,882	16,368
Potassic	3,181	1,823
Other, including mixed	43,424	37,027
Gypsum and plasters	7,768	3,165
Iron and steel, metal, including alloys, all forms	72,919	67,924
Petroleum:		
Crude and partly refined, thousand 42-gallon barrels	3,019	3,490
Refinery products, do	126	105
Silver, metal, including alloys, troy ounces	6,559	3,890
Sulfur, elemental, all forms	6,281	3

Source: Ministério de Economia. Anuario Estadístico, Comercio Exterior. V. 1, 1968, 850 pp.

GUATEMALA

Guatemala's small mining industry continued at about the same pace as in recent years. At yearend, the Guatemala press carried reports of an oil discovery at Las Tortugas in Alta Verapaz Department.

The Government clarified its policy toward investment from North America. Conditions under which such investment would be welcome, which might apply to mining, were set out as follows: The industry should be devoted to the production of export goods, or goods for internal consumption which would replace the necessity for imports; the industry should use a high percentage of domestic raw materials; special techniques must be brought into the country, and such skills must be taught to the country's people; domestic capital should be allowed to participate in foreign enterprises, and necessary financing should be arranged abroad.

Instituto Centroamericano de Investigación y Tecnologia Industrial (ICAITI), headquartered in Guatemala, published two useful works concerning the geology of the Central America region. "Publicaciones Geológicas del ICAITI, Number 2, 1969" consists of 17 papers of geological interest. It contains 88 pages, with maps and illustrations, in both English and Spanish. "Publicaciones Geológicas del ICAITI, Number 3, 1970" contains a metallogenic map of Central America at the scale of 1:2,000,000. The map and metallogenic provinces are discussed in 57 pages of text.

Exploraciones y Explotaciones Mineras Izabal, S.A., owned by International Nickel Co. of Canada, Ltd. (80 percent) and Hanna Mining Co. (20 percent), was waiting for final Government approval to begin major construction on its ferronickel plant.

Other companies reportedly were continuing exploration efforts on nickeliferous prospects in the region of Lake Izabal.

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HONDURAS

On April 23 the formal incorporation of the Honduran iron and steel industry was effected. The new firm was named Altos Hornos de Centro America, S.A. de C.V. Operation was expected to start in 1972 after installation of a $30 million plant. The company was capitalized for $37.5 million. Share interest was held in the following proportions: Central and Development Banks of Honduras, 59 percent; Central American Bank for Economic Integration, 20 percent; Altos Hornos de Mexico, 20 percent; private, 1 percent.[2] Initial production was planned for 113,000 tons of pig iron and 100,000 tons of raw steel annually. This enterprise was more fully discussed in the 1968 Minerals Yearbook, Volume IV, page 853.

The most active company in the mining industry in Honduras during 1969 was New York and Honduras Rosario Mining Co. (NYH). In addition to proving further reserves at its El Mochito mine, the company has entered into separate exploration ventures with Signal Oil and Gas Co. and with American Smelting and Refining Company (ASARCO).

At the El Mochito mine, exploration of the Yojoa ore body revealed about 465,000 tons averaging 10.3 percent lead, 11.4 percent zinc, 8.5 ounces of silver per ton, and minor amounts of cadmium and gold.

NYH and Signal were conducting joint exploration operations of NYH's Minas de Oro property in the State of Comayagua. Signal will earn a 50-percent interest in the 8,600-acre prospect in return for its contribution.

In a joint venture with ASARCO, exploration work began on the south side of the old Rosario mine which has been inactive since 1954. ASARCO will assume 90 percent of the exploration cost in the copper, silver, lead, zinc, and gold property. If the venture proves commercial, NYH will retain 40 percent of the profits, and ASARCO 60 percent, after development costs have been recovered. It was expected that the project would require about 3 years for completion.[3]

[2] Metal Bulletin. No. 5426, Aug. 22, 1969, p. 22.
[3] American Metal Market. V. 76. No. 179, Sept. 22, 1969, p. 16.

Table 4.—Honduras: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
EXPORTS		
Antimony, ore and concentrate	84	188
Cadmium, ore and concentrate	95	113
Cement	29,555	28,231
Lead, ore and concentrate	10,181	12,826
Salt	6,500	6,613
Silver:		
Ore and concentrate—thousand troy ounces	3,495	3,865
Metal, including alloys—do	350	851
Zinc:		
Ore and concentrate	9,745	9,719
Metal, including alloys	19	5
IMPORTS		
Cement	7,760	9,190
Fertilizer materials, crude and manufactured	31,946	37,696
Gas, hydrocarbon, natural and artificial	2,107	2,111
Iron and steel, metal, including alloys, all forms	35,077	29,855
Petroleum:		
Crude and partly refined—thousand 42-gallon barrels	------	2,179
Refinery products:		
Gasoline—do	468	498
Kerosine and jet fuel—do	150	140
Gas oil, diesel oil—do	846	792
Residual fuel oil—do	571	------
Lubricants—do	28	48
Other—do	41	6
Mineral tar and other coal, petroleum, or gas derived crude chemicals	5,519	4,758
Silver metal, including alloys—troy ounces	NA	6,044

NA Not available.

Source: Secretaría de Economía y Hacienda, Dirección General de Estadística y Censos. Comercio Exterior de Honduras 1968. Tegucigalpa, August 1969, 135 pp.

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NICARAGUA

The Government's attitude, as well as that of the private business sector, was cordial toward foreign investment. Desired investment is that slanted toward the use of Nicaragua's natural resources and oriented toward integrated enterprises. U.S. investment in 1969 was reported in a steel-fabricating plant; the growing petrochemical industry might be an area of interest to U.S. investors.

Products of the petrochemical industry in early 1970 were polyvinyl chloride, caustic soda, chlorine, toxaphene, an FF resin, pine oil, and turpentine. Salt will also be produced within the country on a scale large enough to supply a large part of the demand for the manufacture of caustic soda and chlorine.

Neptune Gold Mining Co., owned by American Smelting and Refining Company (ASARCO), New York and Honduras Rosario Mining Co., Terra Nove Explorations, Ltd., and public interests planned to develop the Vesubio lead-zinc project near Bonanza. By mid-1971 the associated companies expect to be producing 2,800 tons of zinc concentrate and 500 tons of lead concentrate monthly. The concentrates will be processed by ASARCO at its zinc refinery in Corpus Christi, Tex., or at its lead smelter in El Paso, Tex.

It was reported [4] that a pipeline project had been suggested to major oil shippers. The pipeline would traverse the narrow southern part of Nicaragua to connect the Pacific and Atlantic coasts. With such a pipeline, Alaskan crude could be transported in foreign flag vessels to and from the pipeline terminals. Under the present law, trade between points in the United States must be carried on in ships of U.S. registry; trade between U.S. and foreign ports can be effected in foreign ships, which usually are operated at a lower rate.

[4] Peruvian Times. V. 30, No. 1518, Jan. 30, 1970, p. 9.

Table 5.—Nicaragua: Foreign trade of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
EXPORTS		
Copper, ore and concentrate	42,249	26,566
Gold metal, unworked or partly worked, troy ounces	145,803	137,784
Gypsum	------	6,293
Salt (excluding brines)	3,548	3,205
Silver metal, including alloys, troy ounces	181,780	159,693
IMPORTS		
Fertilizer materials:		
Nitrogenous	26,093	44,824
Phosphatic	24,031	14,670
Potassic	1,478	2,419
Other	5,691	10,865
Gold metal	15,368	39,385
Iron and steel, metal, including alloys, all forms	34,771	46,747
Petroleum:		
Crude and partly refined, thousand 42-gallon barrels	2,348	2,363
Refinery products:		
Gasoline, do	104	199
Kerosine, do	95	74
Diesel oil, do	99	146
Lubricants, do	r 51	52
Mineral jelly and wax, do	r 8	9
Other, petroleum coke, do	r 43	33
Mineral tar and other coal, petroleum, or gas-derived crude chemicals	9,193	8,670
Salt (excluding brines)	6,900	16,832
Silver metal, including alloys, troy ounces	5,787	6,945

r Revised.

Source: República de Nicaragua. Memoria de la Recaudación General de Aduanas. Managua, Nicaragua. 1967, 281 pp.; 1968, 286 pp.

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PANAMÁ

Mineral industry news centered on the proposed granting of concessions to develop the Cerro Petaquilla copper-molybdenum prospect discovered through the joint effort of the United Nations-Government of Panamá team. Bids were submitted for concessions by some six companies by yearend, but no final announcement had been reached as to the successful applicant.

At midyear, the Government of Panamá released the report on the joint study resulting from the field work. It was called, "Porphyry Copper Mineralization at Cerro Petaquilla Province of Colón," and was being distributed by the Panamá Government.

Indications of mineralization in the area led to the granting of concessions outside of the Cerro Petaquilla reserved zone. Canadian Javelin, Ltd. (through its associate company Oltenia, S.A.) was awarded a 240,801-acre mineral concession in Chiriqui and Veraguas Provinces, adjoining the Petaquilla reserve. It was reported that occurrences of copper were known to exist in the tract.

It was reported at yearend that Oleoductos Trans Panamá, S.A., and the Government of Panamá had readied an agreement giving Oleoductos the right to carry out engineering studies that might lead to the construction of a petroleum pipeline from the Gulf of San Blas to the mouth of the Bayano River. Plans called for 40 kilometers of 40-inch line to be laid overland. The $80 million project was planned to carry 700,000 barrels of oil per day. The land terminals were to be connected to offshore loading facilities which could accommodate tankers in the range of 120,000 deadweight tons.

Oleoductos (a Panamanian corporation) was formed by International Management and Engineering Group Ltd., and Thyssen Stahlunion, of Great Britain and West Germany, respectively.

Foreign trade figures for 1968 were not available for publication, but the 1967 statistics in table 6 show the normal order of magnitude for such trade.

Table 6.—Panamá: Foreign trade of selected mineral commodities

(Metric tons unless otherwise specified)

Imports		1967
Aluminum metal, including alloys, all forms		2,492
Fertilizer materials		31,590
Iron and steel, including alloys, all forms		48,699
Petroleum, crude and partly refined	thousand 42-gallon barrels	19,975

Table 7.—Central American Areas: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 ▸
COSTA RICA				
Cement		110,500	132,177	158,459
Diatomite ▸		10,000	10,000	15,000
Fertilizer materials: Manufactured:				
Nitrogenous, gross weight		17,855	28,000	36,000
Mixed and unspecified, gross weight		42,640	52,000	49,000
Gold ▸	troy ounces	500	500	500
Lime ▸		7,759	8,000	8,000
Petroleum: Refinery products:				
Gasoline	thousand 42-gallon barrels	175	482	510
Kerosine	do.	27	125	144
Distillate fuel oil	do.	254	858	894
Residual fuel oil	do.	158	460	570
Liquefied petroleum gas	do.	------	------	4
Salt [1]		9,804	12,000	8,864
Stone, sand and gravel:				
Gravel and sand ▸		75,000	95,000	105,000
Limestone and other calcareous material ▸		229,492	230,000	240,000
Other ▸		172,000	175,000	350,000

See footnotes at end of table.

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Table 7.—Central American Areas: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
EL SALVADOR			
Aluminum, metal, semimanufactures	822	915	907
Cement	143,054	154,400	141,718
Fertilizers: Manufactured:			
Phosphatic	15,663	8,937	60,911
Nitrogenous	NA	2,868	
Mixed	33,528	41,607	
Iron and steel; steel semimanufactures	24,117	35,670	32,942
Petroleum: Refinery products:			
Gasoline—thousand 42-gallon barrels	1,070	946	575
Kerosine—do	427	369	229
Jet fuel—do	83	84	69
Distillate fuel oil—do	1,083	1,064	549
Residual fuel oil—do	577	869	743
Liquefied petroleum gas—do	105	147	74
Salt	NA	24,230	27,223
Stone, limestone and seashells	245,824	223,795	209,910
GUATEMALA			
Antimony, mine output, metal content	r 50	15	100
Cement—thousand tons	224	180	e 195
Feldspar	1,500	1,900	2,000
Gypsum	11,400	7,700	7,725
Iron ore and concentrate [2]	10,200	3,657	NA
Lead:			
Mine output, metal content	1,160	472	285
Metal, including secondary	71	200	225
Lime	18,550	17,200	17,400
Petroleum: Refinery products:			
Gasoline—thousand 42-gallon barrels	1,178	1,314	1,281
Kerosine and jet fuel—do	485	547	580
Distillate fuel oil—do	2,113	1,498	1,586
Residual fuel oil—do	1,630	1,544	1,759
Liquefied petroleum gas—do	92	79	96
Quartz	34,298	22,800	10,900
Stone, sand and gravel: Crushed and broken:			
Limestone—thousand tons	563	580	590
Dolomite	1,640	2,034	2,040
Other (volcanic ash)	44,286	42,000	45,000
Tungsten, mine output, metal content	100	12	------
Zinc, mine output, metal content	434	NA	931
HONDURAS			
Antimony, mine output, metal content	NA	r 260	113
Cadmium, mine output, metal content	113	128	153
Cement	111,036	128,750	131,727
Gold—troy ounces	5,924	6,150	6,223
Gypsum	13,923	6,561	7,659
Lead, mine output, metal content	11,648	13,175	13,839
Salt	23,484	22,505	27,802
Silver—thousand troy ounces	4,009	4,397	3,905
Stone:			
Dimension stone, marble	[3] 18,000	1,410	NA
Crushed and broken	177,765	199,211	228,327
Zinc, mine output, metal content	13,086	14,783	16,006
NICARAGUA			
Cement	95,924	101,601	109,046
Copper, mine output, metal content	9,336	11,517	4,158
Gold, mine output, metal content—troy ounces	177,702	193,008	120,011
Gypsum and anhydrite, crude	10,000	14,000	30,000
Lime e	28,000	29,500	NA
Petroleum: Refinery products:			
Gasoline—thousand 42-gallon barrels	803	880	660
Kerosine and jet fuel—do	218	219	228
Distillate fuel oil—do	603	741	673
Residual fuel oil—do	561	682	NA
Liquefied petroleum gas—do	46	56	67
Silver, mine output, metal content—troy ounces	372,371	415,847	247,148
Stone: Crushed and broken: Limestone e—thousand tons	215	225	225

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Does not reflect total country production.

[2] Used in cement manufacture.

[3] Square meters.

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The Mineral Industry of Other South American Areas

By Gordon W. Koelling[1]

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ECUADOR

The most significant mineral industry development during 1969 was the continued success of the Cía. Texaco de Petróleos del Ecuador, C.A.-Gulf Ecuatoriana de Petróleos, S.A. (Texaco-Gulf) consortium's petroleum exploration in the Putumayo-Aguarico area of northeastern Ecuador. By yearend, this consortium had completed at least 15 exploratory wells as crude oil producers and had discovered nine fields in the Putumayo-Aguarico area. One of the exploratory wells completed in 1969, Shushufindi 1, was tested from two zones at a combined rate of 5,117 barrels per day, the highest production rate for any well in South America.

Work on clearing the right-of-way for the Texaco-Gulf crude oil pipeline from the Putumayo-Aguarico area to the port of Esmeraldas began during July 1969. This 513-kilometer line, scheduled for completion in mid-1972, will cross the Andes Mountains at a maximum elevation of 13,000 feet and have a capacity of 250,000 barrels per day. A feeder line, expected to be completed sometime during 1970, will extend across the Colombian border to a branch of the Orito-Tumaco export line and serve as a temporary outlet for up to 30,000 barrels per day of Texaco-Gulf's crude oil output pending completion of the pipeline to Esmeraldas.

In June 1969, Texaco-Gulf and the Ecuadorian Government signed a supplementary contract covering the consortium's operations. Among this contract's more important provisions were those dealing with the extent of the consortium's concession areas and its right to construct a pipeline to the Pacific coast. Texaco-Gulf was granted 40-year development concessions covering 500,000 hectares (the consortium had relinquished 931,450 hectares of exploratory area earlier in the year) and was allowed to retain exploratory concessions covering 650,000 hectares. The latter areas must be reduced to 500,000 hectares by 1972 if they are to be converted to development concessions. Texaco-Gulf was authorized to construct a crude oil pipeline to the Pacific which is to have a capacity of not less than 150,000 barrels per day and must be completed by the end of 1972. This line is to become the property of the Government upon amortization of construction costs, but it will continue to be operated by the consortium during the entire period of the development concessions granted by the supplementary contract.

As of yearend 1969, an offshore well being drilled in the Gulf of Guayaquil had reached a depth of 14,400 feet and reportedly had penetrated several promising high-pressure gas sands. This well was being drilled on a concession held by an eight-company, multi-national consortium

[1] Geographer, Bureau of Mines, Washington, D.C.

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Table 1.—Other South American Areas: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
ECUADOR [1]			
Cadmium, mine output, metal content, kilograms	756	404	1,028
Cement, hydraulic, thousand tons	e 390	434	460
Coal, lignite	64	71	NA
Clays, kaolin	372	642	434
Copper, mine output, metal content	415	557	533
Gas, natural:			
Gross production, million cubic feet	6,736	5,837	5,849
Marketed e, do	550	500	500
Gold, mine output, metal content, troy ounces	6,738	8,659	7,287
Natural gas liquids:			
Natural gasoline, thousand 42-gallon barrels	119	113	128
Liquefied petroleum gases, do	14	39	12
Total, do	133	152	140
Petroleum:			
Crude oil, do	2,272	1,815	1,567
Refinery products:			
Gasoline and naphthas, do	2,277	2,788	2,584
Kerosine and jet fuel:			
Kerosine, do	498	569	631
Jet fuel, do	350	401	435
Distillate fuel oil, do	1,200	1,489	1,527
Residual fuel oil, do	e 1,700	1,901	2,329
Other, do	194	43	217
Total, do	e 6,219	7,186	7,723
Silver, mine output, metal content, troy ounces	79,657	136,204	82,163
Sulfur	NA	147	4,894
Zinc, mine output, metal content	161	114	208
FRENCH GUIANA			
Clays, all types	2,400	10,000	1,200
Columbite and tantalite, kilograms	1,000	-----	-----
Gold, metal, troy ounces	7,584	5,099	3,590
Stone, sand, and gravel:			
Crushed and broken, thousand tons	481	708	258
Sand, do	466	104	102
GUYANA [2]			
Aluminum:			
Bauxite:			
Ore, thousand tons	r 3,381	3,722	3,760
Metallurgical and chemical grades, do	r 1,857	r 1,547	2,138
Abrasive and refractory grades [3], do	r 468	r 531	653
Alumina, do	273	270	303
Diamond:			
Gem, carats	e 40,946	e 27,890	30,929
Industrial, do	e 56,406	e 38,421	20,620
Total, do	97,352	66,311	51,549
Gold, troy ounces	2,379	4,088	2,102
Manganese ore and concentrate	178,552	180,760	-----
PARAGUAY			
Cement, hydraulic, thousand tons	14	24	37
Clays: [4]			
Kaolin	140	180	450
Other	380,000	395,000	430,000
Gypsum	1,800	2,300	3,500
Lime	17,600	18,200	19,133
Petroleum, refinery products:			
Gasoline, motor, thousand 42-gallon barrels	333	421	385
Kerosine and jet fuel:			
Kerosine, do	122	124	122
Jet fuel, do	55	50	45
Distillate fuel oil, do	403	474	461
Residual fuel oil, do	196	182	204
Liquefied petroleum gases, do	15	18	42
Total, do	1,124	1,269	1,259
Pigments, natural mineral, iron oxide, ocher [4]	22	25	15
Stone, sand, and gravel: [4]			
Dimension stone, thousand tons	58	58	65
Crushed and broken:			
Limestone, do	51	62	80
Other, do	1,280	1,310	1,420
Sand, do	340	361	420
Talc, soapstone, and pyrophyllite	72	75	90

See footnotes at end of table.

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Table 1.—Other South American Areas: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
SURINAM				
Aluminum:				
Bauxite, ore	thousand tons	5,466	r 5,660	• 5,538
Alumina	do	741	892	• 929
Metal [5]	do	31	44	53
Clays, common •		3,800	2,200	3,170
Gold, metal	troy ounces	r 4,514	r 4,702	2,389
Stone, sand, and gravel:				
Stone, crushed and broken	thousand tons	• 105	66	• 100
Gravel	do	• 8	NA	NA
Sand:				
Common	do	• 105	NA	NA
Stone sand	do	• 15	4	18
URUGUAY				
Aluminum:				
Secondary		250	250	400
Semimanufactures		1,750	1,400	1,305
Cement:				
Hydraulic	thousand tons	416	515	467
Masonry	do	5	3	-----
Clays:				
Refractory		1,933	10,311	NA
Other		55,044	56,205	146,958
Coke, gashouse		21,282	19,653	16,295
Feldspar		1,262	441	1,288
Gas, manufactured	million cubic feet	970	934	913
Gem stones, semiprecious, agate [5]		60	96	74
Iron and steel:				
Iron ore (for cement)		• 2,000	2,200	NA
Steel, crude		13,550	8,500	13,900
Steel, semimanufactures		37,300	32,566	NA
Lime •	thousand tons	70	60	51
Petroleum refinery products:				
Gasoline and naphtha	thousand 42-gallon barrels	2,343	2,041	3,080
Kerosine and jet fuel:				
Kerosine	do	1,271	1,131	1,534
Jet fuel	do	169	124	221
Distillate fuel oil	do	1,440	1,255	• 2,755
Residual fuel oil	do	4,792	4,077	• 4,705
Asphalt	do	69	112	188
Liquefied petroleum gases	do	236	216	546
Other	do	276	28	30
Total	do	10,596	8,984	13,059
Quartz		349	143	620
Stone, sand, and gravel:				
Dimension stone	thousand tons	6	13	67
Crushed and broken:				
Dolomite	do	15	17	34
Limestone	do	727	818	741
Other	do	294	495	524
Gravel	do	107	150	216
Sand	do	750	1,343	2,293
Sulfate, natural		293	334	58
Sulfur [6]		50	• 80	• 110
Talc, soapstone, and pyrophyllite		2,638	2,208	2,306

• Estimate. p Preliminary. r Revised. NA Not available.

[1] Salt and lead are also produced in Ecuador but statistics are not available.

[2] Clay and stone are also produced in Guyana but statistics are not available.

[3] Calcined weight.

[4] Based on industry or Government estimates.

[5] Exports.

[6] Recovered from refinery gases.

for which ADA Oil Exploration Corp., a subsidiary of the U.S.-owned ADA Oil Co., is the operator.

On December 30, 1969, Pennzoil of Ecuador, a subsidiary of the Duval division of Pennzoil United, Inc., and Overseas Mineral Resources Development Corp., a Japanese consortium, submitted bids covering the exploration and exploitation of copper deposits in the Chaucha area of southern Ecuador. According to the local press, the Overseas Mineral Resources Development Corp. bid offered the more favorable terms to the Government and would be accepted. Copper deposits in the Chaucha area were discovered by a United Nations minerals team which reported occurrences of ore containing 0.5 to 0.8 per-

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cent copper and some molybdenum values. Although some sources have speculated that copper reserves of up to 100 million tons may be present, the United Nations survey was only preliminary in nature, and considerable additional exploratory work will probably be necessary to determine if the deposits are commercially exploitable.

Table 2.—Ecuador: Selected exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Copper, scrap	---	575
Gold, concentrates (calaverite)	5	2
Iron and steel, metal, all forms	98	46
Lead, concentrates	671	1,358
Zinc, concentrates	215	495
MINERAL FUELS AND RELATED MATERIALS		
Petroleum, crude thousand 42-gallon barrels	652	---

Source: Departamento Tecnico, Junta Nacional de Planificación y Coordinación. Anuario de Comercio Exterior, v. 2. Quito, Ecuador, 1966, 564 pp.; 1967, 611 pp.

Table 3.—Ecuador: Selected imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum:		
Oxide (alumina) and hydroxide	16	9
Metal, including alloys, all forms	588	935
Copper, metal, including alloys, all forms	562	643
Gold, metal, including alloys, all forms troy ounces	1,350	25,303
Iron and steel, metal:		
Scrap	3	34
Pig iron, ferroalloys, and similar materials	60	148
Steel, primary forms	3,208	11,384
Semimanufactures	70,888	77,336
Lead:		
Oxide (litharge)	176	162
Metal, including alloys, all forms	375	345
Silver, metal, including alloys, all forms troy ounces	67,934	6,719
Tin, metal, including alloys, all forms long tons	31	31
Titanium, metal, including alloys, all forms	251	290
Zinc, metal, including alloys, all forms	52	54
NONMETALS		
Asbestos	375	622
Barite and witherite	781	24
Cement	2,214	2,312
Chalk	520	83
Clays and clay products (including all refractory brick):		
Bentonite	467	132
Kaolin (china clay)	85	25
Other	301	1,000
Diatomite, and other infusorial earths	318	322
Fertilizer materials, crude and manufactured:		
Nitrogenous	9,208	5,439
Phosphatic	9,769	9,600
Potassic	5,546	6,615
Other, including mixed	4,403	7,183
Gypsum and plasters	33	35
Mica, all forms	29	22
Salt (excluding brines)	64	38
Sodium compounds	3,692	4,142
Sulfur	161	142
Talc, soapstone, and pyrophyllite	196	237
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	225	4,589
Carbon black	573	671
Coal, all grades, including briquets	121	309
Coke and semicoke	360	318
Petroleum:		
Crude thousand 42-gallon barrels	5,878	5,798
Refinery products:		
Aviation gasoline do	r 118	185
Jet fuel do	15	57
Lubricants do	r 47	95
Other do	32	37
Mineral tar and other coal, petroleum, or gas derived crude chemicals	170	345

r Revised.

Source: Departamento Tecnico, Junta Nacional de Planificación y Coordinación. Anuario de Comercio Exterior. Quito, Ecuador, 1966 and 1967.

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FRENCH GUIANA

The only significant mineral industry development reported in 1969 was an agreement reached with the Governments of France and Surinam which will permit the exploitation of a bauxite deposit in French Guiana. The project will be undertaken by the Aluminum Company of America (Alcoa) and Cie. de Produits Chimiques et Électrométallurgiques Péchiney of France who will participate on a 75–25 basis, respectively. An eventual bauxite production rate of about 1 million tons annually is anticipated. Plans call for bargaining the bauxite to Alcoa's alumina plant in Surinam for treatment.

Mineral exports were minimal, consisting primarily of gold shipped to France. Recent data on imports were not available.

GUYANA

The output of bauxite registered a modest 1-percent gain during 1969 despite extremely adverse weather conditions in midyear which caused extensive flooding in the mines. In August, normally a dry month, rainfall was higher than during any month since the recording of weather data for the bauxite mining areas was begun in 1941. Another factor which disrupted production somewhat was a 6-day wildcat strike in September at the Reynolds Guyana Mines, Ltd., mining site at Kwakwani. Most of the bauxite shipments from Guyana during 1969 were exported to the United States and Canada.

Demerara Bauxite Co., Ltd. (DEMBA), a subsidiary of Aluminum Co. of Canada, Ltd., initiated preliminary work during September 1969 on a project to expand its alumina production facilities at Mackenzie. Plans are to increase alumina output capacity by about 19 percent to 325,000 tons annually. This project is scheduled for completion during 1971.

In May 1969, Parliament gave retroactive approval to the bauxite mining agreements concluded with Reynolds and DEMBA in 1965. This approval was in the form of legislation which amended Guyana's bauxite mining regulations to take into account the various stipulations of the 1965 agreements. The mining companies were not affected by this legislation since they were already operating on the basis of the 1965 agreements.

Early in 1969, a Canadian uranium mining company, Dennison Mines, Ltd., began an exploration program aimed at locating possible deposits of uranium or other radioactive minerals in a 297,894-hectare area for which it holds exclusive exploration rights. The area involved is in the vicinity of the Pakaraima Mountains just east of where the borders of Venezuela, Brazil, and Guyana meet. Results of a 3-month radiometric survey with a helicopter-mounted scintillometer, completed in April, were considered sufficiently encouraging to warrant a more detailed ground examination which was initiated during the latter part of the year.

Geophysical exploration was carried out during 1969 within the offshore portion of the petroleum concession held jointly by Tenneco Oil Co. and Continental Oil Co.

Table 4.—Guyana: Selected exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1967	1968
METALS			
Aluminum:			
Bauxite:			
Dried		1,853,005	1,806,280
Calcined		466,172	596,642
Oxide (alumina)		273,224	248,151
Gold	troy ounces	262	-----
Manganese, ore and concentrate		194,744	99,159
Platinum-group metals	troy ounces	-----	32
NONMETALS			
Diamond, all grades	carats	r 72,870	70,724
Stone, sand, and gravel: Gravel and crushed rock		r 754	10

r Revised.

[1] In addition to tabulated commodities, Guyana exports small quantities of ferrous and nonferrous scrap and clay, for which data have not been published since 1962.

Source: Guyana Ministry of Economic Development, Statistical Bureau: Monthly Account of External Trade, December 1967, December 1968.

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Table 5.—Guyana: Selected imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, all forms	478	363
Copper, metal, including alloys, all forms	78	57
Iron and steel: Pig iron, crude steel, and semimanufactures	r 26,062	36,070
Silver, unworked and partly worked ..... troy ounces	7,134	5,889
NONMETALS		
Cement	81,460	61,283
Clays and clay products (including refractory brick)	15,992	2,407
Fertilizer materials, crude and manufactured	28,306	36,636
Lime	1,885	5,451
Salt	2,878	3,298
Sodium compounds, n.e.s.: Hydroxide	22,556	21,919
Stone, sand, and gravel: Limestone	11,751	18,580
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	811	129
Petroleum refinery products:		
Gasoline ..... thousand 42-gallon barrels	223	352
Kerosine ..... do	r 202	202
Distillate fuel oil ..... do	630	516
Residual fuel oil ..... do	1,931	2,027
Lubricants ..... do	r 32	35
Asphalt ..... do	75	71
Other ..... do	1	2
Mineral tar and other petroleum or gas derived crude chemicals	155	210

r Revised.

Source: The Statistical Bureau, Ministry of Economic Development. Annual Account Relating to External Trade. 1967 and 1968.

PARAGUAY

There were few significant mineral industry developments in Paraguay during 1969. Industrial, Commercial, Importadora, Exportadora, S.A. (ICIERSA) began the production of steel wire and allied products from imported raw materials at a 10,000-ton-per-year plant during the early part of the year. A cement plant with an annual capacity of 100,000 tons was completed at Valle-mí later.

There was no petroleum exploration activity during the year, but two petroleum concessions were granted. In September, a 1-year exploration concession was awarded to Petrolera General, S.A., a company incorporated in Delaware, by Government decree. This decree specified two Canadian firms, Phoenix Canada Oil, Ltd., and Talent Oil and Gas, Ltd., as Petrolera's technical and financial advisors. In December 1969, the Paraguayan Congress granted an exploration and exploitation concession to a U.S.-owned consortium consisting of Pennzoil de Paraguay and Pierre Schlumberger, Inc. This concession authorizes the consortium to perform surface exploration in a 5-million-hectare area of the Chaco during a 1-year period. At the end of this period, the consortium will be allowed to retain portions of this area totaling 1.2 million hectares for detailed exploration.

Mineral exports were limited to small tonnage shipments of crushed rock, sand, and petroleum products.

Table 6.—Paraguay: Selected imports of mineral commodities

(Metric tons unless otherwise specified)

Commodities	1967	1968
METALS		
Iron and steel, all forms	25,598	23,142
Nonferrous metals, all forms	942	342
NONMETALS		
Crude minerals and manufactures	4,574	6,147
Cement	34,713	8,551
Salt	18,854	20,636
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	4,503	4,958
Solid, including coal, lignite, and briquets	79	52
Liquid, including crude and refined petroleum ..... thousand 42-gallon barrels	1,205	1,266

Source: Banco Central del Paraguay, Departamento de Estudios Económicos. Boletin Estadístico Mensual. No. 19, February 1969.

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SURINAM

Although the output of bauxite declined slightly during 1969, production of alumina and aluminum advanced as a result of plant expansion and the increased availability of electric power. Early in 1969, Suriname Aluminum Co. (Suralco), a subsidiary of Aluminum Co. of America, raised the annual capacity of its alumina plant to 1 million tons by the addition of a fifth 200,000-ton-per-year production unit. Sufficient rain fell in the Suriname River watershed area to enable the Afobaka hydroelectric plant to supply, for the first time, the quantity of electric power necessary for capacity operation of Suralco's 60,000-ton-per-year aluminum smelter.

Although 96 percent of Surinam's 1969 bauxite exports were destined for the United States and Canada, 56 percent of the country's alumina shipments and 85 percent of its aluminum exports went to Europe. Much of that destined for Europe went to members of the European Economic Community (EEC) where Surinam exports are accorded preference because of the country's associate member status. The Dutch firm of N. V. Billiton Mij., which consigned increased quantities of its Surinam bauxite output to Suralco's alumina plant for processing, shipped 41 percent of its alumina exports to the U.S.S.R. and Hungary in 1969. These were the first such shipments from Surinam to Communist countries.

During 1969, Billiton was in the process of stripping overburden in preparation for the opening of its Para bauxite mine in 1970. Reserves at this mine are reported to be larger than those at Kankantrie which is currently the company's main production center.

Several major U.S. aluminum companies, including Kaiser Aluminum & Chemical Corp., Ormet Corp., Reynolds Metals Co., and National South Wire, as well as the French firm Cie. de Produits Chimiques et Électrométallurgiques Péchiney, and the two companies already producing bauxite in Surinam, continued to show interest in plans for developing the bauxite deposits of the Bakhuys Mountains area in the western part of the country. However, negotiations between these companies and the Government during 1969 apparently failed to result in any significant advances toward the signing of development agreements. Bauxite reserves in these deposits have been estimated at between 500 million and 1 billion tons by Government studies.

By the end of 1969, Shell Suriname Exploratie en Produktie Mij., N.V., had drilled 17 exploratory wells on its 1,620,965-hectare onshore petroleum concession. None of these test wells yielded significant results. Under the terms of this concession, granted in November 1968, an additional three wells must be drilled by November 1970.

Table 7.—Surinam: Selected exports of mineral commodities
(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum:			
Bauxite		3,720,899	3,719,927
Oxide (alumina) and hydroxide		684,894	679,889
Metal, including alloys, unwrought		30,828	43,582
Copper, metal, including alloys, unwrought [1 2]		r 100	113
Gold, metal	troy ounces	-----	93
Iron and steel: [1]			
Steel, primary forms		3	67
Semimanufactures		498	3
Lead, metal, unwrought [1 2]		r 43	69
NONMETALS			
Sand, clay, earth		6,709	7,405
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline	42-gallon barrels	r 129	791
Kerosine	do	195	139
Distillate fuel oil	do	r 191	114
Residual fuel oil	do	-----	7
Lubricants	do	r 1,119	548
Other	do	r 69	35

r Revised.
[1] Reexports.
[2] Apparently includes scrap derived from imported metal and metal products.

Source: Algemeen Bureau Voor de Statistiek, Suriname (Bureau of Statistics, Surinam). Maandstatistiek Van de in- en Uitvoer per Goederensoort en per Land. December (cumulative), 1967 and 1968.

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Table 8.—Bauxite, alumina, and aluminum shipments from Surinam

(Metric tons)

Company and destination	1967	1968	1969
BAUXITE			
Suriname Aluminum Co.:			
United States and Canada	2,018,397	2,004,748	2,039,225
Western Europe	118,751	110,575	125,647
Other	17,100	22,961	12,631
Total	2,154,248	2,138,284	2,177,503
N.V. Billiton Mij.:			
United States	1,083,588	1,056,775	1,010,396
Canada	618,131	579,502	487,610
Western Europe	3,048	9,408	-----
Other	6,880	1,901	2,348
Total	1,711,647	1,647,586	1,500,354
Grand total	3,865,895	3,785,870	3,677,857
ALUMINA			
Suriname Aluminum Co.:			
United States	371,117	386,207	314,732
Western Europe	166,965	191,128	194,976
Total	538,082	577,335	509,708
N.V. Billiton Mij.:			
United States	69,907	60,747	60,442
Western Europe	76,549	65,667	146,365
Eastern Europe	-----	-----	144,231
Total	146,456	126,414	351,038
Grand total	684,538	703,749	860,746
ALUMINUM			
Suriname Aluminum Co.:			
Western Europe	31,097	23,023	45,478
Far East	-----	12,348	4,821
Other	-----	8,179	3,488
Total	31,097	43,550	53,787

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Table 9.—Surinam: Selected imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys	r 841	275
Copper, metal, including alloys	94	129
Gold, metal, unworked or partly worked, troy ounces	4,829	4,822
Iron and steel, metal:		
Steel, primary forms	r 47	1
Semimanufactures	r 21,180	12,894
Lead, metal, including alloys, semimanufactures	49	30
Magnesium, metal, including alloys	23	23
Mercury, 76-pound flasks	64	26
NONMETALS		
Asbestos	1,229	981
Cement	50,922	45,916
Chalk	309	271
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s.[1]	970	872
Products	1,646	1,056
Diatomite and other infusorial earths	105	82
Fertilizer materials, manufactured:		
Nitrogenous	3,253	5,868
Phosphatic	81	190
Potassic	101	65
Other, including mixed	161	172
Lime	2,721	2,642
Salt	1,397	1,418
Stone, sand, and gravel:		
Gravel and crushed rock	12,758	31,535
Other	88	154
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural[2]	r 4,461	7,369
Coal, all grades, including briquets	16,875	16,845
Gas, hydrocarbon, natural gas liquids, liquefied petroleum gas	r 4,139	4,270
Petroleum refinery products:[3]		
Gasoline, thousand 42-gallon barrels	r 169	188
Kerosine, do.	44	44
Distillate fuel oil, do.	r 540	595
Residual fuel oil, do.	2,078	2,241
Lubricants, do.	27	28
Other, do.	128	2
Mineral tar and other coal, petroleum, or gas derived crude chemicals	208	168

r Revised.
[1] Includes some sand and other earths.
[2] May include some refinery asphalt.
[3] Excluding LPG and refinery asphalt.

Source: Algemeen Bureau Voor de Statistiek, Suriname (Bureau of Statistics, Surinam). Maandstatistiek Van de in- en Uitvoer per Goederensoort en per Land. December (cumulative), 1967 and 1968.

URUGUAY

Few significant developments occurred with respect to Uruguay's mineral industry in 1969.

Cement output during the year was adversely affected by a prolonged strike against Compañía Uruguay de Cemento Portland, an affiliate of the U.S.-based Lone Star Cement Corp. This company normally accounts for approximately 60 percent of the country's total cement production. Uruguay's other cement producer, the Government-owner Administración Nactional de Combustibles, Alcohol y Portland (ANCAP), was not affected by the strike.

In August 1969, the Government rejected as unsatisfactory the bids of two U.S. companies to carry out petroleum exploration and development in Uruguayan waters. The two U.S. companies, Zapata International Corp. and Oceanic Exploration & Development Corp., were the only firms which responded to the call for such bids earlier in the year. In refusing the bids, the Government announced that it had found it more in the national interest to retain direct responsibility for the development of whatever offshore petroleum resources exist. Subsequently, bids were requested for a 6-month geophysical survey of the area involved. Plans call for the issuance of tenders for other specific technical contracts as needed. All operations will be under the general supervision of ANCAP.

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In mid-1969, ANCAP issued a tender for bids covering the construction of a floating offshore oil terminal on the country's east coast. This terminal is to be designed to handle tankers of at least 100,000 dead-weight tons and will consist of a single point mooring buoy connected to an on-shore tank farm by floating hoselines.

Data on 1968 mineral trade were not available.

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The Mineral Industry of Other European Countries

By Joseph B. Huvos [1] and Bernadette Michalski [1]

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ALBANIA [2]

The Albanian minerals industry produced in 1969, chromite, copper, nickeliferous iron ore, cement, lignite, petroleum, bitumen, and fertilizers. While actual production figures were not available for 1969, it was reported that production goals were exceeded for most mineral products, such as copper ores, chromite, superphosphate, sulfuric acid, coal and petroleum.

Aid by mainland China was significant in the Albanian economy. It has or will make possible construction of about 30 industrial projects such as the Drin and Mat river hydroelectric plants, the Elbasan ferrous metallurgical combine, and the Valas coal mine.

[1] Foreign mineral specialist, Bureau of Mines, Washington, D.C.
[2] Prepared by Joseph B. Huvos.

Table 1.—Albania: Production of selected mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Chromite	327	388	429
Copper:			
Ore	267	1,107	NA
Blister	5	• 14	• 6
Nickeliferous iron ore	405	• 400	• 400
NONMETALS			
Cement	220	• 220	• 220
MINERAL FUELS AND RELATED MATERIALS			
Coal, lignite	434	579	• 640
Petroleum:			
Crude	988	1,135	1,269
Refinery products:			
Gasoline	45	47	NA
Gas oil	105	109	NA
Kerosine	NA	11	NA
Other	NA	353	NA
Total	520	• 520	• 520
Electric power—million kilowatt hours	588	660	• 750

• Estimate. NA Not available.
Source: Vjetari Statistikor iR.P.Sh. 1967–68 (Statistical Yearbook of the Peoples Republic of Albania, 1967–68). Tirana, Albania, 151 pp. (Production figures were compiled by using 1960 figures and rate of growth figures of the specific year; Bureau of Mines files were also used.)

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TRADE

Information released by the Albanian Government shows that the major share of Albania's foreign trade was with mainland China. The volume was estimated to be 65 to 70 percent of Albania's total trade. As in the past, minerals and mineral products continued to dominate Albanian exports. Thus chromium ore (Albania is among the worlds major exporters of chromite), nickeliferous iron ore, copper products, petroleum and bitumen, made up 55 percent of the total volume of exports in 1969. A trade agreement signed with Greece provided for a commodity exchange worth $1.5 million. Mineral commodities supplied by Albania to Greece will include asphalt, ammonium nitrate, and nickeliferous iron ore. A trade agreement was also signed with Austria for 1970.

Table 2.—Albania: Trade of selected mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968
EXPORTS		
METALS		
Chromite	323	[1] 112
Copper:		
Blister	2	NA
Cathodes	1	NA
Nickeliferous iron ore	392	NA
NONMETALS		
Bitumen (natural asphalt)	27	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude	166	NA
Bituminous flux	333	NA
IMPORTS		
METALS		
Iron and steel:		
Pig iron	4	NA
Steel ingots	10	NA
Semimanufactures:		
Pipe	26	NA
Other	41	[1] 9
Total	67	NA
NONMETALS		
Cement	17	NA
Fertilizers	67	[2] 65
Sulfuric acid	468	------
MINERAL FUELS AND RELATED MATERIALS		
Coke	26	NA

NA Not available.
[1] United Nations trade returns. Partial figure for trade with non-Communist countries.
[2] United Nations trade returns. Import from Morocco.

Source: Albania, official trade returns.

COMMODITY REVIEW

Metals.—*Chromium.*—Chrome ores have been mined in Albania at Kukës, Klos, Quafëe Prushit, Bulqizë and Memalisht (2.5 miles north of Pogradec) since their discovery in 1938. After World War II, new mines were opened at Kukës and Martanesh, south of Bulqizë. During the third 5-year plan of 1961–65, new mines started production at Krastë, Kalimash, Kam, Klos, and Kukës, and new ore concentration centers were established. During the fourth and current 5-year plan, new mines were opened at Batër (between Bulqizë and Martanesh), and Lugu i Gjatë, in the same area. Work started also on a large concentrating plant at Bulqizë and a ferrochrome plant in Laç.

Chromite is mined by underground and opencast methods. Ore shipped is guaranteed to contain a minimum of 42 percent Cr_2O_3, with a maximum of 10.5 percent SiO_2, and guaranteed Cr:Fe ratio of at least 3:1. The ore is transported by road to the port of Durrës for export. A small

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quantity is used in Albania for making refractories. The Albanian Government plans to increase domestic consumption by manufacturing of ferrochrome and chemicals. At present, exports seem to be directed principally towards mainland China, North Korea, Yugoslavia, Italy, and the East European countries.[3]

Nickeliferous Iron Ore.—Albania's nickeliferous iron ore deposits are located mainly in the Librazhd-Pogradec area. According to official publications there are three types of ore; (1) a so-called ferronickel ore with about 51 to 52 percent Fe; (2) nickel silicates, with SiO_2 and MgO in higher proportions; (3) nickeliferous bauxite. Only the first is known to be exploited; its nickel content is just under 1 percent, and cobalt content is 0.06 percent. It is a laterite resulting from weathering of ultrabasic igneous rock of Jurassic age and is often found as residual concentrations on lower hill slopes, which can be worked by opencast methods. In 1956, reserves were estimated at 20 million tons.[4]

According to Government releases, one of the projects to be built with mainland China's aid is the new Elbasan metallurgical combine, which is supposed to process 800,000 tons of nickeliferous iron ore to produce pig iron and rolled steel of various types.

Nonmetals. — *Fertilizers.* — The Government reported that unspecified official prospecting plans for phosphorites under the 1966–70 5-year plan were completed. The Government also announced plans for doubling the capacity of the Laç superphosphate plant. The necessary sulfuric acid was to come from a new copper smelter. The plan provides also for building plants for the production of copper sulfate, caustic soda, chlorine, hydrochloric acid, and poly-vinl-chloride (PVC).

The Government plans to double production capacity for nitrogen fertilizers, ammonia, and nitrates and plans to build a urea plant. At present the sole existing ammonia plant in Albania is at Fier and was completed in 1967. It has a production capacity of 41,000 tons of nitrogen per year; output is processed into 110,000 tons of ammonium nitrate.[5]

The new nitrogen fertilizer plant and the planned expansion of the Laç superphosphate plant will make it possible for the chemical industry to increase the amounts of active fertilizer delivered to agriculture. According to plans, active fertilizer, consumption is to be increased from 222 to 425 pounds per hectare.

Mineral Fuels.—*Coal.*—During 1969 large coal reserves were discovered at Valas. With Chinese assistance, plans were made to build a mine and coal-washing plant with a 450,000-ton-per-year capacity.

Petroleum.—Petroleum production increased about 12 percent in 1969. Oil wells drilled during 1968 totaled about 372,000 feet, while during 1969 plans stood for the drilling of 412,000 feet. As reported, one well drilled at Stalin (Kucovë) reached a depth of 11,500 feet.

The Government is planning to further utilize Albanian oil products by building a PVC plant.

Electric Power.—Construction continued with the aid of mainland China on the 250-megawatt Mao-Tse-Tung hydroelectric plant at Vaut Të Dejës on the Drin river, where a 1,000-foot-long dam foundation was completed and construction of a 212-foot-high earth fill dam was started. Construction was scheduled to start on the Fierzë hydroelectric plant, which will reportedly bring the capacity of the Drin river projects to 400 megawatts. The relatively high level of power generation in Albania was due to recent commissioning of two hydroelectric plants on the Mat river, with a total capacity of 50 megawatts, and by other plants located at Bustricës, Cërrik, Kukës, and Fier.

DENMARK [6]

Denmark's commercial mineral resources are limited to nonmetallic construction materials, lignite, and bog iron ore. While there is no domestic crude petroleum output, the refining industry, based entirely on imported crudes, supplies nearly half of the nation's product requirements from its Stigsnaes (Gulf Oil Co.), Kalundborg (Esso), and Fredericia (Shell) refineries.

[3] Metal Bulletin. No. 5482, Mar. 13, 1970, p. 26.
[4] Metal Bulletin. No. 5499, May 15, 1970, pp. 27, 31.
[5] Nitrogen. No. 81, March–April 1969, p. 6.
[6] Prepared by Bernadette Michalski.

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All refineries operated at full capacity, the Stigsnaes and Kalundborg at 70,000 barrels per day each and the Fredericka at 46,000 barrels per day, to be expanded to 52,000 barrels per day by 1970.

The Dansk Undergrunds Consortium (DUC), holding concessions covering all of Denmark and its Continental Shelf, continued exploratory drilling operations in the North Sea. The most promising area was located near the provisional border between the Danish and West German Continental Shelf area, a border established under the equidistance principle as defined in the 1958 Geneva Convention. Under the February 20, 1969, decision of the International Court at the Hague, the border would be redrawn, with this promising area being reassigned to West Germany, on the principle that each nation is entitled to those portions of the Continental Shelf which constitute a natural prolongation of its coastline into and under the sea. However, press reports indicate that following the court judgment, German and Danish representatives met and that while the German claim would be enlarged, the Germans were prepared to renounce any claim to specific areas where previous exploration had indicated probable existence of petroleum-bearing structures, notably these in the former Danish area. Moreover, the West German representatives agreed to consider exploration rights previously granted by the Danish and Dutch Governments to various companies in the areas to be taken over.

Other activities engaged by the DUC in 1969 included the mid-year completion of a shallow water seismic survey off Sjaelland and the launching of a survey in the Skagerrak. Exploratory studies off the Jutland Coast, abandoned since 1967, were to be resumed early in 1970.

The value of mineral commodity exports at current prices increased to approximately $130 million in 1968 as compared with $114 million in the previous year. While exports of liquid fuels and nonmetalic minerals made appreciable gains, exports of metal semimanufactures registered the greatest growth. Steel exports increased by more than 30 percent, taking advantage of sales to the European Economic Community (EEC) where prices were held above world market levels in 1968.

Mineral commodity imports at current prices increased by value to $675 million in 1968 as compared with $645 million in the previous year. Liquid fuel imports totaled $315 million or 47 percent of total mineral imports while iron and steel product imports totaled $175 million or 26 percent of total mineral imports.

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Table 3.—Denmark: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969 p
METALS				
Iron and steel:				
Iron ore (less than 42 percent iron)	thousand tons	57	• 55	• 40
Pig iron	do	75	75	• 80
Steel ingots and castings	do	397	419	• 450
Steel semimanufactures	do	• 410	452	428
Lead, secondary		9,900	9,700	NA
NONMETALS				
Cement, hydraulic	thousand tons	2,200	2,070	• 2,400
Chalk		35,000	• 34,000	NA
Clays, kaolin:				
Crude		15,000	• 15,000	• 15,000
Washed		3,000	• 3,000	• 3,000
Diatomaceous materials:				
Diatomite	thousand tons	20	• 20	• 15
Moler •	do	200	200	200
Fertilizers:				
Manufactured, phosphatic, other, P_2O_5 content		r 55,000	65,000	NA
Mixed, and unspecified, gross weight		• 715,000	• 718,000	NA
Limes:				
Quicklime		190,000	• 190,000	• 190,000
Agricultural		290,000	• 280,000	• 275,000
Salt		100,000	150,000	• 150,000
MINERAL FUELS AND RELATED MATERIALS				
Coal, lignite only	thousand tons	• 1,900	760	• 500
Coke, all types	do	268	221	NA
Fuel briquets, lignite briquets only	do	27	22	NA
Petroleum refinery products:				
Gasoline, all kinds	thousand 42-gallon barrels	9,453	9,578	11,441
Kerosine and jet fuel	do	966	1,467	1,528
Distillate fuel oil	do	13,250	14,195	19,187
Residual fuel oil	do	19,502	21,761	26,067
Liquefied petroleum gases	do	1,582	1,715	NA
Bitumen	do	399	647	NA
Other	do	2,613	702	NA

• Estimate. p Preliminary. r Revised. NA Not available.

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Table 4.—Denmark: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum:			
Oxide and hydroxide [1]	114	148	United Kingdom 92; France 14.
Metal, including alloys:			
Unwrought, including scrap	1,854	3,216	Sweden 1,407; West Germany 791.
Semimanufactures	1,496	2,679	Sweden 842; United Kingdom 523.
Antimony metal, including alloys	15	110	United Kingdom 16; France 14; West Germany 11.
Copper metal, including alloys:			
Scrap	4,381	4,981	Belgium-Luxembourg 2,224; West Germany 2,216.
Unwrought	494	1,307	West Germany 749; Italy 288.
Semimanufactures	2,026	2,580	United Kingdom 919; Sweden 378; Norway 298.
Iron and steel:			
Ore and concentrate	27,607	16,467	West Germany 8,389; Netherlands 1,430; United Kingdom 1,195.
Roasted pyrite	88,290	103,111	West Germany 71,605; United Kingdom 31,506.
Metal:			
Pig iron, ferroalloys, and similar materials [2]	63,159	72,586	West Germany 35,308; Sweden 24,618.
Steel, primary forms	2,446	2,626	Norway 2,519.
Semimanufactures:			
Bars, rods, angles, shapes, sections	58,609	101,198	West Germany 49,935; United Kingdom 27,341.
Universals, plates and sheets	109,371	129,989	Sweden 46,192; Norway 39,252.
Tubes, pipes, and fittings	9,678	12,982	Sweden 7,301; Poland 1,220.
Castings and forgings, rough	3,300	3,127	Sweden 1,536.
Other	27,986	18,327	West Germany 9,692.
Total semimanufactures	208,944	265,623	
Lead metal, including scrap:			
Unwrought, including scrap	5,677	5,740	Norway 2,514; Colombia 729.
Semimanufactures	40	77	NA.
Magnesium metal, including alloys, all forms	48	45	United States 31.
Manganese oxides	262	3	Mainly to United Arab Republic.
Nickel metal, including alloys, scrap and semimanufactures	249	217	United Kingdom 56; Sweden 50; West Germany 35.
Silver:			
Waste and sweepings value, thousands	$1,415	$1,382	United Kingdom $515; West Germany $368.
Metal, including alloys, semimanufactures do	$149	$180	West Germany $77.
Tin metal, including alloys:			
Unwrought, including scrap long tons	1,077	1,024	Hungary 354; Norway 119.
Semimanufactures do	49	55	NA.
Titanium dioxide	158	88	Sweden 36; Finland 25.
Zinc:			
Oxide	20	9	Mainly to Iceland.
Metal, including alloys:			
Scrap, including blue powder (dust)	3,261	3,796	West Germany 933; Norway 892.
Unwrought and semimanufactures	455	473	NA.
Other:			
Ash and residues containing nonferrous metals	4,359	4,972	Netherlands 1,581; Sweden 1,333.
Oxides, hydroxides, and peroxides of metals, n.e.s	10	4	Mainly to West Germany.
Base metals, including alloys, all forms, n.e.s	20	116	NA.
NONMETALS			
Cement	111,338	178,705	United Kingdom 47,428; Iceland 26,478; Sweden 25,590.
Chalk	23,884	22,641	Sweden 8,192; West Germany 7,190.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s	4,347	4,762	Finland 2,723; Sweden 1,064; Norway 857.

See footnotes at end of table.

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Table 4.—Denmark: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
NONMETALS—Continued			
Clays and clay products (including all refractory brick)—Continued			
Products:			
Refractory [1]	43,776	38,178	United Kingdom 8,081; West Germany 6,071; Netherlands 5,686.
Nonrefractory	123,866	109,355	West Germany 73,871; Norway 24,561.
Cryolite and chiolite	28,291	28,800	NA.
Diamond:			
Gem, not set or strung value, thousands	$44	$71	Sweden $31; Belgium-Luxembourg $25.
Industrial do	$6	$6	All to Sweden.
Diatomite and other infusorial earths	106,321	97,470	West Germany 45,627; United Kingdom 36,034.
Fertilizer materials (manufactured, all types)	17,813	12,210	East Germany 8,995.
Lime	25,866	25,653	Norway 11,199; Sweden 11,080.
Pigments, mineral, including processed iron oxide	80	99	Finland 43; Costa Rica 28.
Salt	13,008	11,117	Norway 6,736; Sweden 4,066.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	NA	43,881	West Germany 43,666.
Worked	2,100	3,117	Sweden 1,619; Norway 1,263.
Gravel and crushed rock thousand tons	1,899	1,667	West Germany 1,635.
Limestone (except dimension)	101,145	98,421	Sweden 47,810; West Germany 38,635.
Quartz and quartzite	10,853	69	West Germany 24.
Sand, except metal bearing	129,360	118,096	Sweden 88,690; Norway 6,897.
Sulfuric acid	125	8,993	United Kingdom 8,860.
Other nonmetals, n.e.s.:			
Crude	2,851	-------	
Slag, dross and similar waste, not metal bearing:			
From iron and steel manufacture	5,254	3,844	All to West Geramny.
Slag and ash, n.e.s	64,464	69,378	West Germany 69,327.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,042	151	West Germany 65; Sweden 57.
Carbon black	120	221	Sweden 85; Norway 75.
Coke and semicoke	72,807	79,635	Sweden 39,889; Norway 30,528.
Gas, hydrocarbon, liquefied thousand tons	17	[4]	NA.
Peat, including peat briquets and litter	4,661	2,837	West Germany 2,485.
Petroleum, refinery products:			
Gasoline thousand tons	292	316	Sweden 240; Netherlands 26.
Kerosine and jet fuel do	14	11	Mainly to Sweden.
Distillate fuel oil do	372	294	Do.
Residual fuel oil do	118	231	Sweden 192; Netherlands 21.
Lubricants do	17	9	Norway 4.
Other do	16	40	Norway 22; Finland 15.
Mineral tar and other coal, petroleum or gas derived crude chemicals	18,693	16,450	Netherlands 12,919.

NA Not available.
[1] Including synthetic corundum.
[2] Including spiegeleisen and grit, sponge, or powder of iron and steel.
[3] Including those of magnesite, diatomite, and other refractory materials.
[4] Less than ½ unit.

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Table 5.—Denmark: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum:			
Oxide and hydroxide [1]	2,471	1,230	United States 877; Germany 214; Japan 80.
Metal, including alloys:			
Scrap	613	3,136	Norway 1,694; Sweden 1,119.
Unwrought	9,073	10,008	Norway 6,747; Canada 1,588; United Kingdom 1,174.
Semimanufactures	17,091	19,022	West Germany 3,167; Sweden 3,059; Switzerland 2,590.
Antimony metal, including alloys, all forms	120	67	West Germany 35.
Cadmium metal, including alloys, all forms	21	24	Belgium-Luxembourg 9; Norway 9.
Chromium oxide and hydroxide	441	400	West Germany 183; United Kingdom 116; France 113.
Cobalt metal, including alloys, all forms	22	24	Belgium-Luxembourg 10.
Copper metal, including alloys:			
Unwrought, including scrap	4,172	4,530	West Germany 2,053; Belgium-Luxembourg 1,932.
Semimanufactures	22,578	25,249	Sweden 10,448; Belgium-Luxembourg 4,075; West Germany 3,020.
Iron and steel:			
Ore and concentrate	1,234	1,020	Sweden 835; Norway 180.
Roasted pyrite	6,403	5,483	All from Norway.
Metal:			
Scrap	608	1,034	Sweden 878.
Pig iron, including cast iron [2]	32,805	22,723	West Germany 9,201; U.S.S.R. 5,449; Norway 4,623.
Ferroalloys	9,697	15,125	Norway 12,972.
Steel, primary forms	91,788	158,466	Norway 64,378; West Germany 48,211; Sweden 30,693.
Semimanufactures:			
Bars, rods, angles, shapes, sections [3]	347,429	344,882	West Germany 123,594; France 58,744; Belgium-Luxembourg 44,485.
Universals, plates and sheets	460,550	453,789	West Germany 112,721; Sweden 95,244; United Kingdom 71,543; France 59,023.
Hoop and strip	62,925	63,860	Belgium-Luxembourg 24,412; West Germany 21,452; Netherlands 7,386.
Rails and accessories	21,583	18,762	France 11,070; Belgium-Luxembourg 4,547.
Wire	9,543	19,475	West Germany 6,662; Belgium-Luxembourg 6,402; Sweden 3,293.
Tubes, pipes, and fittings	137,726	120,696	West Germany 48,440; United Kingdom 17,445; France 13,233.
Castings	87	9	Sweden 3; West Germany 3.
Total semimanufactures	1,039,843	1,020,973	
Lead:			
Oxides	961	1,233	Mexico 535; Sweden 191; United Kingdom 169; West Germany 165.
Metal, including alloys:			
Scrap	7,950	6,015	Norway 2,873; Singapore 751.
Unwrought	11,348	11,264	Sweden 5,274; Republic of South Africa 3,298; Canada 1,156.
Semimanufactures	631	586	West Germany 329; United Kingdom 128.
Magnesium metal, including alloys, all forms	159	122	Norway 69; Sweden 17; Italy 12; West Germany 11.
Manganese:			
Ore and concentrate	8,654	9,351	Ivory Coast 4,767; Netherlands 2,642.
Oxides	1,566	1,523	Japan 963; Netherlands 296; Belgium-Luxembourg 181.
Mercury, 76-pound flasks	522	363	Sweden 116; United States 58; Italy 58.
Molybdenum metal, including alloys, all forms, kilograms	2,000	---	
Nickel:			
Ore and matte	26	143	NA.
Metal including alloys:			
Unwrought, including scrap	73	84	United Kingdom 65.
Semimanufactures	527	472	United Kingdom 192; West Germany 80.
Platinum-group metals and silver, including alloys, all forms:			
Platinum group value, thousands	$408	$533	Switzerland $183; Netherlands $130.
Silver, do	$5,404	$5,161	Norway $2,273; West Germany $1,411; Switzerland $664.

See footnotes at end of table.

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Table 5.—Denmark: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS—Continued			
Tin metal, including alloys:			
Scrap—long tons	311	254	Norway 51; West Germany 49.
Unwrought—do	1,096	1,106	Mainland China 305; Thailand 265; Netherlands 163.
Semimanufactures—do	93	77	West Germany 39.
Titanium, oxides	5,954	6,150	Norway 1,567; Netherlands 1,552; United Kingdom 1,516.
Tungsten metal, including alloys, all forms—kilograms	2,000	5,600	Sweden 3,800; United Kingdom 800.
Zinc:			
Oxide	1,696	1,624	West Germany 776; Netherlands 300; East Germany 110; Belgium-Luxembourg 110.
Metal, including alloys:			
Blue powder, including scrap	309	535	Norway 227; United Kingdom 131; Poland 116.
Unwrought	7,757	10,820	Norway 3,223; Netherlands 2,406.
Semimanufactures	7,418	6,301	Poland 2,567; Belgium-Luxembourg 1,867; Yugoslavia 854.
Other:			
Ore and concentrate of base metals, n.e.s	19	468	Australia 203; mainland China 202.
Ash and residue containing nonferrous metals	1,021	1,535	Sweden 1,073; West Germany 303.
Metals, including pyrophoric alloys	5	7	Mainly from United States.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	5,559	3,554	Italy 1,749; West Germany 1,279.
Dust and powder of precious and semiprecious stones including synthetic—value, thousands	$24	$41	Belgium-Luxembourg $36.
Asbestos	23,493	25,124	Canada 11,627; Cyprus 5,658; Republic of South Africa 4,170.
Barite and witherite	1,948	938	West Germany 836; France 63.
Boron materials:			
Crude natural borates	1,260	1,831	United States 1,031; Turkey 800.
Oxides and acids	120	231	France 118; mainland China; 55.
Cement	3,170	6,485	Czechoslovakia 3,808.
Chalk	697	2,008	West Germany 1,042; United Kingdom 435; France 394.
Clays and clay products (including all refractory brick):			
Crude clays, kaolin and other clays	61,218	63,883	United Kingdom 40,735; Czechoslovakia 11,255; West Germany 5,762.
Products:			
Refractory (including nonclay bricks)	29,684	28,307	West Germany 9,645; Sweden 8,518; Austria 5,028.
Nonrefractory	47,786	41,840	West Germany 21,156; Sweden 6,437; Japan 5,206.
Diamond, gem, not set or strung value, thousands	$1,353	$1,015	Belgium-Luxembourg $389; Switzerland $264; Israel $115.
Diatomite and other infusorial earths	2,531	4,146	United States 3,297; West Germany 288.
Feldspar	4,817	4,978	Norway 4,259; Sweden 707.
Fertilizer materials:			
Crude:			
Sodium nitrate	13,820	6,044	All from Chile.
Phosphate rock	280,859	274,372	Morocco 184,855; U.S.S.R. 53,851; Tunisia 27,453.
Potash salts	1,021	1,354	All from West Germany.
Manufactured:			
Nitrogenous	323,255	295,919	Norway 251,362 ;West Germany 42,683.
Phosphatic, including Thomas slag	24,172	42,717	Netherlands 16,825; West Germany 8,917.
Potassic	245,423	209,776	West Germany 134,126; France 35,275.
Fluorspar	1,704	3,627	Norway 1,245; East Germany 620; United Kingdom 596; Tunisia 500.
Graphite, natural	288	301	Norway 115; West Germany 91; United Kingdom 68.
Gypsum and plasters	108,683	115,234	Poland 100,473; West Germany 8,815; France 3,911.
Lime	1,320	1,396	West Germany 1,226; United Kingdom 101.
Magnesite	4,127	5,194	Austria 2,830; mainland China 808; Poland 460; Netherlands 429.

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Table 5.—Denmark: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS—Continued			
Mica:			
Crude, including splittings and waste	347	403	United Kingdom 148; Norway 109.
Worked, including agglomerated splittings	68	116	West Germany 99.
Pigments, mineral:			
Natural, crude	294	329	Cyprus 188; West Germany 119; France 42.
Iron oxides, processed	4,234	3,268	West Germany 2,644; Spain 374.
Precious and semiprecious stone, except diamond—value, thousands	$606	$1,319	India $642; West Germany $420.
Pyrite	113,363	118,406	Spain 77,879; Norway 41,006.
Salt	148,763	190,020	West Germany 128,522; United Kingdom 22,612; Poland 8,670.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous, (including marble)	11,705	8,896	Sweden 5,741; Italy 1,866.
Slate	11,333	12,854	Norway 7,120; Sweden 3,431; West Germany 1,423.
Other (granite, gneiss, etc.)	38,326	39,348	Sweden 38,998.
Worked, all types	28,377	35,383	Sweden 16,658; Portugal 13,425; West Germany 3,921.
Dolomite, chiefly refractory grade	21,594	22,071	Norway 14,530; West Germany 3,736; Sweden 2,455.
Gravel and crushed rock	380,514	380,026	Sweden 289,707; Norway 81,858.
Limestone (except dimension)	45,604	50,509	Sweden 41,696.
Quartz and quartzite	25,329	11,015	Sweden 9,114.
Sand, excluding metal bearing	79,859	73,149	Belgium-Luxembourg 54,203; Sweden 8,612; West Germany 5,494.
Sulfur:			
Elemental, all forms	6,478	5,995	Poland 2,850; France 1,770.
Sulfur dioxide and sulfuric acid	9,552	3,547	West Germany 2,841; East Germany 428.
Talc, steatite, soapstone, and pyrophyllite	14,061	14,377	Norway 7,366; Sweden 4,238; West Germany 1,391.
Other nonmetals, n.e.s.:			
Crude	24,733	44,946	West Germany 28,499; Sweden 7,587; Norway 7,416.
Slag, dross and similar waste, not metal bearing	23,495	37,715	Sweden 11,819.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,407	1,729	United States 1,384.
Carbon black	2,335	2,633	United Kingdom 876; West Germany 750; United States 519.
Coal and briquets:			
Anthracite and bituminous coal, including briquets thousand tons	3,631	4,255	Poland 3,482; U.S.S.R. 586; United Kingdom 88.
Lignite and lignite briquets	105,506	94,179	East Germany 94,070.
Coke and semicoke—thousand tons	596	447	West Germany 183; U.S.S.R. 87; Czechoslovakia 74.
Gas, hydrocarbon, liquefied—do	78	87	West Germany 65.
Peat, including peat briquets and litter	8,881	5,856	Sweden 4,818.
Petroleum:			
Crude and partly refined thousand tons	6,485	6,781	Kuwait 2,114; Libya 1,298; Saudi Arabia 839; Bahrain 523.
Refinery products:			
Gasoline—do	797	905	United Kingdom 234; Sweden 170; Netherlands Antilles 134; West Germany 105.
Kerosine and jet fuel—do	416	544	United Kingdom 207; Netherlands 140; Italy 91; Spain 84.
Distillate fuel oil—do	2,746	3,063	Trinidad and Tobago 288; Netherlands 238; Sweden 209; Italy 175.
Residual fuel oil—do	2,195	2,832	U.S.S.R. 458; Sweden 228; Poland 203; Norway 159; Netherlands 122.
Lubricants—do	91	104	United Kingdom 52; Norway 9; Sweden 8; West Germany 5.
Other bituminous mixtures, n.e.s.—do	240	243	Netherlands Antilles 110; West Germany 71; Sweden 31.
Total—do	6,485	7,691	

NA Not available.

[1] Not including synthetic corundum.

[2] Including spiegeleisen, grit, sponge, and powder of iron and steel.

[3] Including wire rod.

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GREENLAND [7]

Denmark's largest territorial possession, Greenland, reported no significant mineral production in 1969 nor does it engage in mineral commodity trade to any appreciable extent.

Mineral commodity exports were limited to 67,000 tons of cryolite, small quantities of metal scrap and coal with a total value of $1.8 million in 1967 and $1.3 million in 1968. Mineral commodity imports totaled $6.7 million in 1967 and $8.6 million in 1968. Expenditures for liquid fuels constituted slightly more than half of the total expenditure for mineral commodity imports in both years. The area, however, has drawn the interest of mineral exploration groups. Geologic characteristics similar to those of the Canadian arctic oilfields have prompted approximately 40 applications for oil concessions. Petroleum prospects are reportedly most favorable in the West Greenland Basin in the area extending from Ingeret to Gronne Island, a land area of 6,000 square kilometers and an adjoining offshore area of 100 to 150 kilometers. The developing interest for mineral concessions in Greenland have prompted the Danish Government to make fiscal provisions more attractive to investors and foster State participation in resulting future production ventures.

Among applicants now seeking mineral exploration and production rights are a consortium formed by Tenneco, Amerada and Compagnie Française de Pétroles; Ente Nazionale Indrocarburi (ENI-Italy); Dominion Explorer (Canada); Cominco Ltd. (Canada); and Ponderay Polar (Denmark). While most of the concession interest are centered in petroleum, exploration teams for lead-zinc ore and chromite have been active on the west coast and southwest coast, respectively. Cominco Ltd. and the Danish Ministry of Greenland entered mining concession negotiations for the Marmorilik fjord lead-zinc deposits, estimated to contain 2 million tons of ore averaging 20 percent combined lead and zinc content.

ICELAND [8]

Indigenous mineral resources are limited to a few industrial nonmetallics, production of which remained relatively stable in 1969. Increased diatomite output reflected a full year operation of the 12,000-ton per year-capacity plant under joint ownership by the Icelandic Government and Johns-Manville Corp. (United States). Iceland's large hydroelectric power potential (estimated at 35 million megawatt hours per year) was a major factor in the introduction of aluminum production to that nation's economy. The Burfell hydroelectric project and the Hafnarfjodur (Straumsvik) aluminum smelter come on stream in mid-year. The 30,000-ton-capacity smelter is operated by Icelandic Aluminum Co. (Isal), a subsidiary of Swiss Aluminium Ltd. (Switzerland). Operations were underway in 1969 to expand plant capacity to 60,000 tons by 1972.

Expansion of the fertilizer manufacturing industry was under consideration during the year. A 70,000-ton-per-year capacity plant costing $2.7 million was proposed. The plant will adjoin the present 8,500-ton-per-year-capacity ammonium nitrate plant of Icelandic State Fertilizer at Gufunes and is expected to provide self-sufficiency through 1980 in manufactured nitrogen-phosphate-potassium fertilizers, nitrogenous phosphate fertilizer, and ammonium nitrate fertilizers.

Iceland imports its total annual petroleum product requirement of more than 500,000 tons. Of this total, about 75 percent is obtained from the U.S.S.R. The Government has proposed construction of a 700,000-ton-per-year-capacity (13,400 barrel-per-day) petroleum refinery costing $14.5 million. The proposed refinery will be 51 percent Icelandic owned, with the Government seeking a package deal with one party for crude oil, processing, and exports. The Icelandic petroleum product demand is highly imbalanced with large demands for gas oil and lesser demands for heavy fuel oil than exist in most other countries.

The European Free Trade Association (EFTA) Council in session on December 4, 1969, outlined terms by which Iceland

[7] Prepared by Bernadette Michalski.
[8] Prepared by Bernadette Michalski.

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would accede to membership in the association in March 1970. Included in the terms were the gradual reduction of Icelandic import duties on industrial products from EFTA countries. Basically the timetable requires an immediate 30 percent reduction on existing protective duties followed by 10 percent reductions on January 1, 1974, and on each January 1 thereafter with the final 10 percent removed on January 1, 1980.

In connection with Iceland's entry into EFTA a $14 million fund was established by Denmark ($2.7 million), Finland ($2.7 million), Iceland ($0.5 million), Norway ($2.7 million), and Sweden ($5.4 million) to foster the development of export industries and strengthen the competitive ability of Iceland's domestic industry. The sums are to be made available over a 4-year period and are to be repaid, free of interest, over a 15-year period beginning in 1980.

Iceland is dependent upon imported products for most of its mineral commodity requirements, and consequently about 18 percent of all Icelandic imports by value, or $25.4 million, was attributed to mineral commodity imports in 1968. More than 60 percent of total mineral import expenditures were for mineral fuels, while iron and steel accounted for 18 percent and manufactured fertilizers for 10 percent. Import expenditures for alumina feedstock for the new aluminum plant, with a value estimated at $3 million in 1969 somewhat altered the traditional Icelandic mineral import pattern in this year.

Mineral commodity exports valued at $0.3 million in 1968 were comprised chiefly of scrap metal and diatomite. In 1969 an estimated additional $6 million was added to mineral export value with the emergence of aluminum ingot exports.

Table 6.—Iceland: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Aluminum, primary	-------	-------	12,400
Scrap, all types	NA	3,488	4,416
NONMETALS			
Cement	115,904	100,000	92,684
Diatomite	NA	2,750	7,600
Fertilizers, manufactured:			
Nitrogenous, gross weight	23,900	24,336	24,350
Nitrogen content	2,800	2,847	2,849
Stone, sand, and gravel:			
Dimension stone	NA	37,000	17,500
Crushed and broken	NA	87,500	86,800
Sand, calcareous	252,000	273,000	252,000

NA Not available. p Preliminary.

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Table 7.—Iceland: Selected mineral commodity trade

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destination or source, 1968
EXPORTS			
METALS			
Scrap, all kinds	1,232	800	NA.
NONMETALS			
Diatomite	-------	2,138	West Germany 1,254.
IMPORTS			
METALS			
Aluminum and alloys, unwrought and semimanufactures	334	831	Switzerland 286; United Kingdom 122; Norway 102.
Copper and alloys, unwrought and semimanufactures	235	142	NA.
Iron and steel, semimanufactures:			
Bars, rods, angles, shapes, sections	18,125	16,075	Belgium-Luxembourg 3,273; Norway 2,306; Czechoslovakia 2,001.
Universals, plates and sheets	9,252	8,072	Belgium-Luxembourg 2,619; United Kingdom 1,701.
Hoop and strip	749	779	NA.
Tubes, pipes and fittings	4,428	3,915	West Germany 1,198; Denmark 543.
Lead and alloys, unwrought and semimanufactures	267	NA	NA.
Silver and platinum, all forms value, thousands	$118	$105	NA.
NONMETALS			
Cement	43,189	17,071	All from Denmark.
Clay products:	8,645	2,500	United Kingdom 1,005.
Refractory	1,611	1,637	NA.
Nonrefractory	1,130	864	United Kingdom 332.
Fertilizers, manufactured:			
Nitrogenous bulk	NA	3,656	France 2,492.
Phosphatic bulk	8,656	9,871	All from Norway.
Potassic bulk	7,356	7,832	East Germany 4,293.
Other bulk	11,769	18,511	Netherlands 17,822.
Salt	43,189	57,230	Spain 45,413.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	NA	2,749	West Germany 2,252.
Coal, all grades, including briquets	5,485	3,708	NA.
Coke and semicoke	NA	1,183	NA.
Petroleum refinery products:			
Gasoline all kinds	64,605	56,189	U.S.S.R. 49,646.
Kerosine, jet fuels and white spirits	33,417	43,775	Netherlands Antilles 19,405; United Kingdom 18,397.
Distillate fuel oils	285,296	338,281	U.S.S.R. 261,394.
Residual fuel oils	107,899	106,648	U.S.S.R. 104,827.
Lubricants, including greases	4,489	4,637	United Kingdom 3,478.
Liquefied petroleum gas	400	NA	NA.
Bitumen	5,000	NA	NA.

NA Not available.

SWITZERLAND [9]

Indigenous mineral resources continued to sustain a modest output of several nonmetallic mineral commodities such as cement, lime, and gypsum. The aluminum industry, based entirely on imported raw materials, meets Swiss consumption requirements and provides for a small export of ingot and semimanufactures. The steel industry and the petroleum refining industry, also based on imported raw materials, meet a substantial portion of the Nation's requirements in these commodities.

The Swiss gross national product (GNP) in terms of 1958 dollars rose by 5.2 percent in 1969 as compared with the nearly 4.0 percent 1968 growth rate indicated by revised figures. The nation's economy is highly dependent upon trade which constitutes nearly half of the GNP. Industrial production rose by 11 percent in 1969 with export-oriented industries accounting for the major growth. The chemical industry registered a 25-percent growth and the metal processing industry registered an 18-percent growth. Industrial employment was high, with tightening labor market condi-

[9] Prepared by Bernadette Michalski.

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tions resulting from legislation which stabilized the level of resident foreign labor by placing absolute quotas on the number of foreign nationals entering the labor market.

Petroleum, the nation's basic energy source, supplied 77 percent of total energy consumed in 1969. Petroleum product consumption totaled 11 million tons. Crude imports increased by 8.3 percent in 1969 to 4.96 million tons. About 44 percent of the crude imports was obtained from Libya with Algeria and the Middle East supplying 26 percent each. Refinery product imports increased by 7 percent totaling 6.7 million tons, the bulk of which (6.1 million tons) was derived from sources in the European Economic Community (EEC).

Hydroelectric power accounted for 15.5 percent of total energy consumption, solid fuels provided 5.2 percent, and nuclear power installations supplied the small remainder.

Switzerand's first nuclear reactor, Beznau I was placed in service at 350 megawatt capacity. A second adjoining plant of equal capacity is scheduled for completion late in 1971. Both units are turnkey operations of a Westinghouse and Brown-Boveri consortium.

Total value of mineral exports was $231.3 million in 1968 as compared with $207.9 million in 1967. Nonferrous metal exports constituted about 36 percent of the mineral export by value or $82.3 million. Precious and semiprecious stones contributed about 30 percent or $69.8 million to total mineral exports. The EEC received about 52 percent of the mineral exports by value or $121.2 million, and the European Free Trade Association (EFTA) received about 23 percent or $53.8 million.

Total value of mineral imports was $862.8 million in 1968, as compared with $769.5 million in 1967. Petroleum, iron and steel and nonferrous ores and metals constituted the bulk of mineral imports contributing 77 percent or $665.8 to the total mineral import by value. The EEC continued to account for the major portion of mineral imports providing 63 percent ($545.8 million) in 1968.

Table 8.—Switzerland: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Aluminum, metal, primary ---- metric tons	72,320	76,855	77,060
Iron and steel:			
Pig iron	24	22	25
Ferroalloys (ferrosilicon)	2	6	6
Steel, ingots and castings	445	458	507
Steel semimanufactures	480	490	515
NONMETALS			
Cement, hydraulic	4,176	4,321	4,534
Gypsum e	100	100	100
Lime	153	147	150
Salt	216	255	267
MINERAL FUELS AND RELATED MATERIALS			
Coke, gas plant	275	250	237
Gas, manufactured, all types ---- million cubic feet	12,608	13,344	13,121
Petroleum refinery products:			
Gasoline	698	711	807
Kerosine and jet fuel	63	62	94
Distillate fuel oils	1,624	1,930	2,099
Residual fuel oil	1,271	1,393	1,591
Liquified petroleum gas	201	212	233
Asphalt, refinery	------	80	120
Other including naphtha	74	87	94

e Estimate. p Preliminary.

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Table 9.—Switzerland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum:			
Oxide and hydroxide	66	88	United States 16; West Germany 12.
Metal, including alloys:			
Unwrought	19,829	24,212	West Germany 11,228; Italy 3,985; United Kingdom 3,104.
Semimanufactures	26,374	27,007	United Kingdom 2,784; Denmark 2,784; Sweden 2,648.
Cobalt oxide and hydroxide	3	1	All to France.
Columbium and tantalum, tantalum metal, including alloys, all forms	14	5	West Germany 2; United Kingdom 1.
Copper:			
Metal, including alloys:			
Scrap	10,451	12,782	West Germany 7,870; France 2,207; Italy 1,265.
Unwrought	4,595	6,347	Italy 2,364; West Germany 2,337.
Semimanufactures	9,966	9,911	United States 3,331; Italy 1,251; Israel 1,185.
Gold metal, unworked or partly worked thousand troy ounces	888	1,789	West Germany 599; France 351; Italy 266; Brazil 227.
Iron and steel:			
Ore and concentrate, including roasted pyrite	14,568	10,474	Mainly to West Germany.
Metal:			
Scrap	30,509	39,335	Italy 25,919; West Germany 9,304; France 2,321.
Pig iron, including cast iron, sponge iron, powder and shot	3	188	Mainly to Sweden.
Ferroalloys	11,950	9,409	West Germany 4,718; Italy 2,310.
Steel, primary forms	5,271	3,971	Italy 3,118.
Semimanufactures:			
Bars, rods, angles, shapes, sections	22,384	21,310	Italy 12,085; Austria 4,038; West Germany 3,225.
Universals, plates and sheets	3,149	4,185	Austria 2,034; France 1,227.
Hoop and strip	2,539	3,989	Austria 2,391; West Germany 921; France 174.
Rails and accessories	NA	1,073	Mainly to West Europe.
Wire	5,640	6,179	France 1,565; Italy 1,389.
Tubes, pipes, and fittings	39,917	48,954	United States 9,858; Austria 7,183; Denmark 4,408.
Castings, and forgings, rough	136	265	Mainly to West Europe.
Total	73,765	85,955	
Lead metal, including alloys:			
Scrap	5,287	5,407	Italy 5,078.
Unwrought	20	381	NA.
Semimanufactures	256	354	Mainly to West Europe.
Magnesium metal, including alloys, all forms	100	126	West Germany 62; Sweden 14; Netherlands 13.
Mercury 76-pound flasks	94	135	Netherlands 53; India 40; West Germany 13.
Molybdenum metal, including alloys, all forms	2	1	All to West Germany.
Nickel:			
Matte, speiss, and similar materials	76	7	Mainly to West Germany.
Metal, including alloys:			
Scrap	519	651	West Germany 305; Italy 202.
Unwrought	60	6	NA.
Semimanufactures	950	1,300	France 295; Netherlands 158; United Kingdom 146.
Platinum-group metals and silver, including alloys:			
Platinum group thousand troy ounces	85	131	Italy 38; France 34; United States 16; United Kingdom 14.
Silver do	6,116	4,989	Italy 1,608; West Germany 773; France 631.
Silicon, elemental	4,395	6,299	West Germany 2,886; Japan 1,700; U.S.S.R. 500.
Tin metal, including alloys:			
Scrap long tons	60	86	Mainly to West Germany.
Unwrought and semimanufactures do	72	82	Mainly to West Europe.
Tungsten, including alloys, all forms	26	45	West Germany 41.
Zinc metal, including alloys:			
Scrap	1,257	1,526	Italy 1,321.
Unwrought	391	166	Mainly to West Germany.
Semimanufactures	232	179	Austria 47; West Germany 35; Netherlands 33.

See footnote at end of table.

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Table 9.—Switzerland: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS—Continued			
Other:			
Ash and residues containing nonferrous metals	16,524	17,145	West Germany 6,371; Belgium-Luxembourg 2,426; France 1,014.
Metals, including alloys, all forms:			
Alkali, alkaline earth, and rare-earth metals.....kilograms	630	1,563	West Germany 1,039.
Base metals, including alloys, all forms, n.e.s.	19	26	Mainly to West Europe.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	16	24	NA.
Grinding and polishing wheels and stones	635	656	West Germany 214; United Kingdom 131.
Asbestos	74	32	West Germany 8; France 5; Belgium-Luxembourg 4.
Cement	23,894	103,868	West Germany 82,359; France 12,390.
Chalk	31	65	Mainly to West Germany.
Clays and clay products (including all refractory brick):			
Crude clay	10,598	454	Austria 352.
Products:			
Refractory (including nonclay bricks)	1,253	1,548	Mainly to West Europe.
Nonrefractory	49,738	59,032	West Germany 27,724; France 16,910; Austria 10,957.
Diamond:			
Gem, not set or strung value, thousands	$10,860	$14,628	France $4,515; West Germany $3,089; Italy $1,349.
Industrial.....do	$1,082	$1,791	West Germany $491; Belgium-Luxembourg $394; United Kingdom $262.
Diatomite and other infusorial earth	48	82	West Germany 43; Austria 22.
Feldspar and fluorspar	77	210	West Germany 123; Sweden 49.
Fertilizer materials, manufactured:			
Nitrogenous	22,263	21,721	United Kingdom 13,312.
Other	121	258	West Germany 131; Italy 105.
Graphite, natural	50	1	NA.
Gypsum and plasters	1,366	2,226	Austria 2,151; Italy 32; West Germany 19.
Lime	2,141	2,167	France 1,104; West Germany 602; Austria 349.
Magnesite	47	43	West Germany 20; France 10.
Mica:			
Crude, including splittings and waste	60	107	West Germany 45; France 21; Italy 19.
Worked, including agglomerated splittings	209	185	Netherlands 29; Austria 23; Sweden 20.
Precious and semiprecious stone, except diamond:			
Natural.....thousand carats	28,750	79,505	France 54,665; West Germany 9,140; United Kingdom 5,820.
Manufactured.....do	186,520	226,950	West Germany 8,445; France 4,625; United States 2,605.
Salt and brines	7	6	France 2; West Germany 1.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	8,061	8,886	Austria 3,657; Czechoslovakia 3,442; West Germany 1,199.
Caustic potash	14	32	Mainly to France.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	33,107	39,462	West Germany 26,789; Austria 4,204; Italy 3,931.
Worked	5,860	6,963	West Germany 5,875; Netherlands 377; Austria 261.
Dolomite	68	120	France 5.
Gravel and crushed rock	36,954	37,045	West Germany 23,141; France 11,679; Austria 1,390.
Limestone (except dimension)	31	33	Mainly to Austria.
Quartz and quartzite	15,058	17,776	Italy 14,731; Netherlands 990; West Germany 878.
Sand, excluding metal-bearing	13,632	19,598	France 8,603; Italy 6,032; West Germany 3,709.
Sulfur:			
Elemental	226	206	All to West Germany.
Sulfuric acid	7,172	7,819	West Germany 7,456; France 202.
Talc, steatite, soapstone, pyrophyllite	1,734	2,059	Mainly to Italy.
Other nonmetals, n.e.s., bromine, iodine, fluorine	13,834	21,363	NA.

See footnote at end of table.

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Table 9.—Switzerland: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2,349	782	United Kingdom 485; France 282.
Carbon black	152	201	Italy 92; U.S.S.R. 26.
Coal, all grades, including briquets	3	4	France 2.
Coke and semicoke	23,040	35,558	Italy 14,344; Austria 12,005; West Germany 9,160.
Hydrogen, helium, rare gases	3	1	NA.
Peat, including peat briquets and litter	185	412	Austria 290; France 82; West Germany 38.
Petroleum refinery products:			
Gasoline (including natural) thousand tons	11	12	Mainly to Austria.
Distillate fuel oil do	r 11	12	Netherlands 5; France 3.
Residual fuel oil do	155	183	Mainly to Austria.
Lubricants do	3	6	Syrian Arab Republic 2.
Other:			
Petroleum coke do	11	10	West Germany 6.
Bituminous mixtures, n.e.s	436	449	Yugoslavia 192; Finland 80; Rumania 53.
Mineral tar and other coal, petroleum, or gas derived crude chemicals	1,464	2,277	Mainly to West Europe.

r Revised. NA Not available.

Table 10.—Switzerland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum:			
Bauxite and concentrate	592	335	France 200.
Oxide and hydroxide	144,165	161,899	France 110,103; Guinea 49,169; Italy 1,787.
Metal, including alloys:			
Unwrought	6,801	15,577	Norway 12,368; Austria 1,192; Poland 1,017.
Semimanufactures	6,722	8,067	West Germany 4,258; Sweden 958; United Kingdom 879.
Antimony metal, including alloys, all forms	659	737	Republic of South Africa 169; mainland China, 141; Japan 125; Belgium-Luxembourg 107.
Arsenic trioxide, pentoxide, and acids	86	122	France 63; Sweden 23; United States 6.
Beryllium metal, including alloys, all forms kilograms	47	31	NA.
Chromium:			
Chromite	3,972	2,644	Republic of South Africa 2,340.
Oxide and hydroxide	521	528	West Germany 311; France 82; East Germany 70.
Cobalt oxide and hydroxide	5	6	Belgium-Luxembourg 5; Canada 1.
Copper:			
Metal, including alloys:			
Scrap	558	638	Israel 307; Canada 133.
Unwrought	42,274	38,667	Belgium-Luxembourg 12,987; Zambia 7,949; West Germany 7,430.
Semimanufactures	21,200	22,324	United Kingdom 8,117; West Germany 3,449; Canada 2,573.
Gold metal, unworked and partly worked thousand troy ounces	r 365	413	West Germany 272; France 82; United Kingdom 27; United States 22.
Iron and steel:			
Ore and concentrate, including roasted pyrite	21,489	24,071	Sweden 9,019.
Metal:			
Scrap	22,796	26,896	West Germany 18,677; Austria 2,849.
Pig iron, including cast iron, sponge iron, spiegeleisen, powder and shot	56,615	57,816	West Germany 37,022; Netherlands 5,107; United Kingdom 4,575.
Ferroalloys	11,106	17,974	West Germany 6,671; Czechoslovakia 2,894; France 2,182.
Steel, primary forms	162,785	185,104	France 87,093; West Germany 82,336.
Semimanufactures:			
Bars, rods, angles, shapes, sections:			
Wire rod thousand tons	47	61	France 28; West Germany 16; Austria 8.
Other bars and rod do	127	144	West Germany 64; France 47.
Angles shapes and sections do	204	332	West Germany 110; France 92; Belgium-Luxembourg 82.

See footnotes at end of table.

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Table 10.—Switzerland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS—Continued			
Iron and steel—Continued			
Semimanufactures—Continued			
Bars, rods, angles, shapes, sections—Continued			
Universals, plates and sheets...thousand tons	486	495	France 170; West Germany 146.
Hoop and strip ...do	137	24	West Germany 10; Austria 8.
Rails and accessories ...do	42	48	Austria 14; West Germany 13; France 8; Belgium-Luxembourg 8.
Wire...do	21	22	West Germany 7; Austria 6; United Kingdom 2.
Tubes, pipes, and fittings ...do	113	122	West Germany 72; France 21.
Castings and forgings, rough...do	8	2	All from West Germany.
Total...do	1,180	1,250	
Lead:			
Oxides	236	203	West Germany 99; Mexico 56; France 40.
Metal, including alloys:			
Unwrought, including scrap	20,237	20,223	Canada 4,166; France 4,038; West Germany 2,491; Belgium-Luxembourg 2,274.
Semimanufactures	567	616	West Germany 550.
Magnesium metal, including alloys, all forms	r 1,048	803	Norway 680; Canada 71; United Kingdom 25.
Manganese, oxides	620	632	Japan 395; Belgium-Luxembourg 117; West Germany 65.
Mercury...76-pound flasks	r 306	791	Italy 362; West Germany 151; United Kingdom 100.
Molybdenum metal, including alloys, all forms	12	8	Austria 6.
Nickel:			
Metal including alloys:			
Scrap	191	73	West Germany 39; Israel 30.
Unwrought	1,122	1,519	United Kingdom 763; Norway 368.
Semimanufactures	1,112	962	United Kingdom 423; West Germany 275.
Platinum-group metals and silver, metals, including alloys, all forms:			
Platinum group thousand troy ounces	109	142	U.S.S.R. 35; United Kingdom 23; West Germany 18; United States 16.
Silver...do	20,322	18,671	Mexico 6,484; West Germany 5,563; United States 2,451.
Silicon metal, including alloys, all forms	278	243	Norway 141; France 50.
Tin:			
Oxide...long tons	21	26	West Germany 15.
Metal, including alloys:			
Unwrought...do	868	869	Netherlands 321; Malaysia 180; Thailand 119.
Semimanufactures...do	117	110	Mainly from West Europe.
Titanium oxides	7,327	8,970	West Germany 3,566; United Kingdom 2,711.
Tungsten:			
Ore and concentrate	45	NA	
Metal, including alloys, all forms	72	108	West Germany 94; France 7; Austria 4.
Zinc:			
Oxide	1,308	1,145	West Germany 436; Netherlands 292; Belgium-Luxembourg 197.
Metal, including alloys:			
Unwrought	24,501	25,809	Belgium-Luxembourg 8,445; West Germany 5,796; Zambia 2,777; North Korea 2,664.
Semimanufactures	1,764	1,555	Belgium-Luxembourg 830; West Germany 450.
Other:			
Ore and concentrate	8,972	5,270	Republic of South Africa 2,840; Australia 2,214.
Ash and residues containing nonferrous metals	1,515	1,386	West Germany 948; France 342; United Kingdom 50.
Metals, including alloys, all forms:			
Metalloids	1,389	NA	NA.
Alkali, alkaline earth and rare-earth metals	266	338	West Germany 304.
Pyrophoric alloys	11	11	West Germany 5.
Base metals, including alloys, all forms	659	737	Mainland China 141; Japan 122; Belgium-Luxembourg 107.

See footnotes at end of table.

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Table 10.—Switzerland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	1,519	1,302	West Germany 664; Italy 482; United States 94.
Grinding and polishing wheels and stones	1,357	1,326	West Germany 638; United Kingdom 152; Austria 150.
Asbestos	12,712	14,999	Canada 8,046; U.S.S.R. 2,272; Republic of South Africa 2,127.
Barite and witherite	2,249	1,826	West Germany 1,328; France 331.
Boron materials:			
Crude natural borates	752	757	United States 659.
Oxide and acid	486	488	France 269; Turkey 109; Italy 72.
Cement	30,665	33,470	France 14,461; West Germany 7,749; Italy 5,828.
Chalk	11,827	14,530	France 13,163; West Germany 794; Italy 505.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s	181,542	172,610	West Germany 75,927; United Kingdom 51,568; France 25,119.
Products:			
Refractory (including nonclay bricks)	20,740	20,402	West Germany 13,594; France 1,986.
Nonrefractory	115,926	122,718	Italy 97,972; West Germany 14,978.
Cryolite and chiolite	890	651	All from Denmark.
Diamond, industrial—value, thousands	$1,339	$2,160	Belgium-Luxembourg $673; West Germany $608.
Diatomite and other infusorial earths	1,949	2,029	United States 601; Denmark 356; France 337; West Germany 311.
Feldspar and fluorspar	14,827	17,325	France 8,398; West Germany 4,320; Italy 3,451.
Fertilizer materials:			
Crude:			
Nitrogenous	381	401	West Germany 386.
Phosphatic	27,497	21,957	Morocco 12,215; Belgium-Luxembourg 3,251.
Potassic	83,032	87,091	France 54,916; West Germany 22,647.
Other	19,914	20,665	France 20,071; Peru 192; Republic of South Africa 186.
Manufactured:			
Nitrogenous	4,469	2,552	Italy 839; Austria 650; France 505.
Phosphatic:			
Thomas (basic) slag	200,580	198,784	France 128,636.
Other	16,432	17,885	Belgium-Luxembourg 6,473; France 5,956; Netherlands 2,865.
Potassic	15,190	18,169	France 9,727; West Germany 6,597.
Other, including mixed	21,881	31,528	West Germany 11,176; France 10,945; Belgium-Luxembourg 4,926.
Ammonia	9,409	5,155	Austria 4,134; West Germany 652.
Graphite, natural	470	508	Austria 249; West Germany 172; Italy 40.
Gypsum and plasters	59,866	63,332	West Germany 31,201; Austria 20,886.
Lime	14,921	17,449	Italy 14,692.
Magnesite	3,362	3,350	Austria 3,208; West Germany 68.
Mica:			
Crude, including splittings and waste	640	688	West Germany 290; Norway 124; United Kingdom 115.
Worked, including agglomerated splittings	214	190	France 116; Belgium-Luxembourg 70.
Pigments, mineral:			
Natural, crude	372	475	West Germany 221; Austria 128; France 85.
Iron oxides, processed	2,043	2,200	West Germany 2,076; Spain 40.
Precious and semiprecious stone, except diamond:			
Natural—thousand carats	126,805	177,565	United States 61,580; Brazil 42,865; West Germany 21,850.
Manufactured—do	93,915	100,425	France 96,310; Italy 2,635.
Pyrites (gross weight)	45,987	42,217	Mainly from Italy.
Salt and brines	943	1,600	France 1,437; West Germany 72.
Sodium and potassium compounds n.e.s.:			
Caustic soda	4,792	7,169	West Germany 3,395; France 1,867.
Caustic potash, sodic and potassic peroxides	3,136	2,927	France 1,175; East Germany 631; West Germany 544.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	51,785	41,986	Italy 16,448; Austria 15,864; France 8,018.
Slate	2,836	13,002	West Germany 764; Italy 188.
Other	39,766	34,253	West Germany 13,031; Italy 12,081; France 7,360.

See footnotes at end of table.

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Table 10.—Switzerland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
NONMETALS—Continued			
Stone, sand, and gravel—Continued			
Dimension Stone—Continued			
Worked:			
Slate	1,391	1,882	Italy 1,152; West Germany 148.
Paving and flagstone	16,431	21,212	Italy 14,406; Austria 6,880.
Other	7,674	8,406	Italy 5,632; West Germany 1,182.
Dolomite	12,676	12,629	Italy 6,718; France 3,503; Norway 956.
Gravel and crushed rock thousand tons	3,558	3,824	France 2,024; West Germany 1,000; Italy 637.
Limestone (except dimension)	56,031	53,913	France 49,137; Italy 3,802.
Quartz and quartzite	10,649	19,923	Italy 15,482; Belgium-Luxembourg 3,755.
Sand, excluding metal bearing thousand tons	857	907	Italy 491; Belgium-Luxembourg 142; West Germany 141.
Sulfur:			
Elemental:			
Other than colloidal	42,111	35,241	United States 14,128; France 14,031; Poland 6,401.
Colloidal	187	336	West Germany 262.
Sulfur dioxide	19	25	Mainly from France.
Sulfuric acid	962	1,148	West Germany 533; France 296; Italy 246.
Talc, steatite, soapstone, and pyrophyllite	12,738	12,361	France 4,712; Austria 4,530; Italy 1,693.
Other nonmetals, n.e.s.:			
Crude	64,029	57,451	France 24,582; West Germany 16,202.
Slag, dross and similar waste, not metal bearing	48,878	30,595	France 21,008; West Germany 6,251; Italy 3,251.
Oxides and hydroxides of magnesium, strontium, barium	194	272	West Germany 123; United Kingdom 64; United States 44.
Bromine, iodine, fluorine	1,001	1,225	France 962; Netherlands 78.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,018	944	Trinidad and Tobago 685; United States 293.
Carbon black	6,985	7,556	France 2,837; Netherlands 1,377; West Germany 1,150.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	644	570	West Germany 356; Czechoslovakia 53; France 42.
Briquets of anthracite and bituminous coal do	20	22	West Germany 10; France 7.
Lignite and lignite briquets do	106	98	Mainly from West Germany.
Coke and semicoke do	282	296	West Germany 243; Netherlands 25.
Hydrogen, helium, rare gases	777	1,106	Italy 861; West Germany 99; France 88.
Peat and peat briquets thousand tons	39	41	Mainly from West Germany.
Petroleum:			
Crude and partly refined do	3,936	4,578	Algeria 1,974; Libya 1,106; Bahrain 572.
Refinery products:			
Gasoline (including natural) do	1,140	1,229	Italy 425; West Germany 356; France 292.
Kerosine and jet fuel do	50	78	Italy 37; France 16.
Distillate fuel oil do	3,265	3,979	Italy 1,159; West Germany 865; France 652.
Residual fuel oil do	611	553	France 229; West Germany 185.
Lubricants do	78	80	Italy 25; Netherlands 14; West Germany 12.
Mineral jelly and wax do	8	9	West Germany 4.
Other:			
Petroleum and pitch coke do	r 56	64	West Germany 30; United States 27.
Bitumen and other residues do	267	232	West Germany 96; France 81; Italy 31.
Mineral tar and other coal, petroleum, or gas derived crude chemicals do	24	30	West Germany 12; France 10; Netherlands 2.

r Revised. NA Not available.

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The Mineral Industry of Other Areas of Africa

By Henry E. Stipp [1] and Eugene R. Slatick [2]

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BOTSWANA [3]

Botswana's mineral industry received strong support for planned mine development when the Government obtained a $2.5 million [4] credit from the International Development Association, a unit of the World Bank. The credit was for financing costs of engineering design and preliminary works for infrastructure necessary for developing proposed copper, copper and nickel, and diamond mines. At yearend the Government was planning to invite tenders for construction of the $2 million Shashi Dam, which will form a part of the Shashi Complex. Botswana's Government concluded an agreement with the Republic of South Africa for a revision of the Customs Union agreement of 1910. A significant change in the agreement provides trade protection for infant industries of Botswana and also gives a substantial increase in the share of revenue received by the smaller nation. The United Kingdom agreed to provide additional financial assistance of $12.6 million to Botswana. The United States, through the Agency for International Development (AID), has agreed in principle to assist in the development of the Shashi Complex.

The National Assembly passed the Precious Stones Industry Act to regulate and control the new diamond industry. Comprising 29 sections, the act covers subjects such as prospecting, discovery, mining, disposal, sale, purchase, transport, and rights of the Government.

A large area of the Tati concession, totaling about 338,500 acres, was given to the Botswana Government by South African interests. However, owners of the Tati Company still retained mineral rights to the area.

Production of mineral commodities in

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[3] Prepared by Henry E. Stipp.

[4] Where necessary, values have been converted from South African Rand (R) to U.S. dollars at the rate of R1=US$1.40.

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1969 was negligible, being valued at $516,887 compared with output valued at $945,000 in 1968.

Table 1.—Botswana: Production of mineral commodities

Commodity	1967	1968	1969
METALS			
Manganese, ore and concentrate, gross weight metric tons	4,253	24,098	e 22,470
NONMETALS			
Gem stones, rough, semi-precious kilograms	-----	1,835	6,044
Talc and related materials:			
Talc metric tons	726	125	51

e Estimate.

Table 2.—Botswana: Foreign trade in selected mineral commodities

(Exports in metric tons; imports in thousand U.S. dollars)

Commodity	1967 [1]	1968 [1]
EXPORTS:		
Metals: Manganese ore and concentrate	4,253	9,998
Nonmetals: Talc	73	124
IMPORTS:		
Mineral fuels and lubricants	r 3,409	3,431

r Revised.

[1] The Standard Bank Review (Johannesburg). No. 610, January 1970, p. 27.

Foreign trade in minerals in 1968 consisted of exports of manganese ore valued at $301,367 and talc valued at $2,031. In 1967, manganese ore exports were valued at $31,922; talc was valued at $1,120. Imports of mineral commodities in 1968 were mainly mineral fuels and lubricants valued at $3.4 million. In 1967 imports of these commodities also were valued at $3.4 million.

Africa Triangle Mining, Prospecting and Development Co. reportedly discovered three rich copper deposits.[5] The company, in which United States Steel Corp. and Anglo Vaal Group of South Africa are shareholders, reported that the deposits are in a copper belt stretching from the Democratic Republic of the Congo (Kinshasa) through Zambia and Botswana into South-West Africa. Drilling in South-West Africa indicated extensive reserves.

A survey of copper resources in the Matsitamma area disclosed three deposits: Makala and Thakadu, where proved and probable reserves have been estimated at 4.7 million tons of sulfide ore, containing 2.24 percent copper and 1.7 million tons, containing 2.15 percent copper, respectively; and Logolo, where probable ore reserves were estimated at 580,000 tons containing 1.88 percent copper.[6]

Botswana Roan Selection Trust (BRST) planned to start developing its copper-nickel deposits at Selebi and Pikwe.[7] Metallgesellschaft, a West German firm, agreed to purchase two-thirds of the nickel and all of the other metals produced by BRST for 15 years. BRST would obtain a loan of about $35 million from German sources to develop the mines. Copper-nickel matte, from a concentrator and smelter that will be constructed between Selebi and Pikwe, will be refined in the American Metal Climax Inc. refinery at Port Nickel, Louisiana.

Anglo-American Corporation of South Africa, Ltd. and the owners of mineral rights in the Tati area concluded an arrangement that gave Anglo-American the right to prospect the area for a 15-month period. Reportedly, deposits similar to those at Selebi and Pikwe occur; however, reserves in the area have not been proved. Two promising areas occur near Mount Selkirk and Mount Struck.

A subsidiary of De Beers Consolidated Mines Ltd. was evaluating the diamond pipe recently discovered at Orapa in the Letlhakane area.[8] The kimberlite pipe, reportedly the second largest in Africa, was estimated to cover an area of about 280 acres. De Beers was scheduled to spend about $32 million in the next 2 years to develop the diamond-bearing pipe and any other deposit that might be found in the area. Production was expected to begin in 1971 and reach an estimated 3 million carats by 1975. A contract for construction of 165 houses and single quarters for 200 workers was awarded to Cosgrin (Botswana) Pty. Ltd. by the Anglo-American Corp.[9] The mining township will be constructed near Orapa, 143 miles west of Francistown. Cosgrin also will construct foundations and buildings to house the diamond recovery plant. The Government of Botswana plans to build an all weather road from Francistown to Orapa.

[5] Engineering and Mining Journal. New African Copper Finds Seem Promising. V. 170, No. 12, December 1969, p. 93.

[6] Annales Des Mines (Paris). Botswana. No. 9, September 1969, pp. 81–82.

[7] Mining Journal (London). Botswana BRST Production Plans. V. 274, No. 7027, Apr. 24, 1970, p. 370.

[8] Engineering and Mining Journal. Botswana. V. 170, No. 6, June 1969, p. 304.

[9] Mining Journal. Botswana Mining Township Contract. V. 273, No. 7004, Nov. 14, 1969, p. 433.

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BURUNDI [10]

The mineral industry of Burundi consisted mainly of the mining and concentrating of bastnaesite, a rare-earth mineral, and cassiterite, an ore of tin. To diversify the economy, the Government of Burundi and the United Nations Development Program began a joint project for studying the feasibility of developing the nation's mineral resources. The project, which will cost about $1,174,300,[11] was directed toward exploiting previously mined minerals and locating other economic mineral deposits. Photogeologic mapping of the country was begun, and an airborne geophysical survey to be followed by ground investigation of promising areas was planned. In 1969 the Governments of Burundi and the United States signed an Investment Guaranty Agreement.

Production of mineral commodities were valued at $320,000 in 1969, compared with $640,000 in 1968. Foreign trade in mineral commodities in 1968 was confined mainly to exports of gem diamonds, valued at $4.3 million, and tin ore and concentrates, valued at $139,000. In 1967 exports of these minerals were valued at $3 million and $100,000, respectively. Imports of mineral commodities in 1968 consisted of mainly petroleum products, valued at $1.6 million, and iron and steel semimanufactures, valued at $1.2 million. In 1967 these imports were valued at $1.4 million and $857,000, respectively.

Bastnaesite concentrate produced by Société Minerale de Karonge (SOMIKA) continued to increase in quantity; however, the outlook for future sale of the concentrate was clouded by a decrease in the grade of ore. SOMIKA planned to reopen a cassiterite mine at Mulehe near the Rwanda border. The mine was expected to produce five to six tons per month initially and reach a top output of 10 tons per month. Tungsten and tantalite deposits in the lake area of Burundi were being investigated for future exploitation.

Reportedly, a group of United Nations mineral specialists found traces of copper in rocks at Rushubi near Bujumbura. This revived hope that exploitable deposits of copper would be discovered. Indications of diamond in samples taken from the southeastern Mosso area were reported; however, the quantity of diamond involved was unknown. The possibility of commercial ex-

[10] Prepared by Henry E. Stipp.

[11] Where necessary, values have been converted from Burundi Francs (RBF) to U.S. dollars at the rate of RBF87.5=US$1.00.

Table 3.—Burundi: Production of mineral commodities

Commodity [1]	1967	1968	1969
METALS			
Gold, mine output, metal content troy ounces	482	643	---
Rare-earth metals, bastnaesite concentrates, gross weight metric tons	300	525	600
Tin, ores and concentrate, gross weight long tons	45	148	108
NONMETALS			
Lime metric tons	NA	NA	800

NA Not available.

[1] In addition to commodities listed, construction materials, such as clays and sand and gravel are produced, but quantitative data are not available.

Table 4.—Burundi: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968 [1]
EXPORTS		
METALS		
Copper, metal and alloys, unwrought	300	NA
Tin, ore and concentrates long tons	44	67
Zinc, metal and alloys, unwrought	100	NA
Nonferrous base metal ore concentrates	10	NA
NONMETALS		
Diamond, gem value, thousands	$3,034	$4,335
Fertilizer materials do	[1] $269	$259
IMPORTS		
METALS		
Iron and steel, metal, semimanufactures	908	3,626
NONMETALS		
Pigments	31	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum products, lubricants and greases	------	282

NA Not available.

[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1967, pp. 463–466; and V. 3, 1968, pp. 686–690.

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ploitation of this deposit has not been evaluated. Calcareous soil found in Bubanza Province north of Bujumbura could be used to make cement.

Former gold producing areas of the country were scheduled for exploration under the United Nations Development program.[12] Indications of copper and lead were found in the northwestern part of the country, mercury near Gitega, nickel and cobalt in the south, and manganese in the foothills of the Buhoro mountains.

CAMEROON [13]

The Federal Republic of Cameroon continued to produce mainly aluminum, gold, and tin, which contributed negligible value to the economy of the country. However, increasing interest in the bauxite deposits near Minim-Martap, copper deposits in the Poli area, and exploration for crude petroleum along the costal shelf indicated an expanding role for the nation's mineral industry.

An aerial isomagnetic survey of parts of southeastern and central Cameroon, being conducted under a $1 million grant from the Canadian Government, could uncover commercial mineral deposits. The United Nations was engaged in a project to reorganize Cameroon's Geologic Service and to study anomalies discovered by the aerial survey. The French Atomic Energy Commission was studying radioactive anomalies in Cameroon discovered in the Dja series in the Sembé Ouesso region of the Congo (Brazzaville). Cameroon Government agencies were studying water resources in the northern part of the country and geothermal anomalies in the central and northern and western sections. The Bureau de Récherches Géologiques et Minières (BRGM) was conducting hydrogeologic studies on the Logone aquifer in the Chadian basin of northern Cameroon.

Production of mineral commodities in 1969 were valued at an estimated $24.4 million compared with an estimated $23.7 million in 1968.[14] Foreign trade in mineral commodities in 1968 consisted of mainly exports of primary aluminum valued at $17.9 million compared with $23.3 million in 1967. Imports of mineral commodities in 1968 were mainly iron and steel semimanufactures valued at $8.0 million and petroleum products valued at $2.8 million. In 1967 these mineral commodity imports were valued at $6.0 million, and $3.2 million, respectively.

Compagnie Camerounaise de l'Aluminium Pechiney-Ugine was expanding its smelter located near Edea. Capacity was to be increased from 50,000 tons per year to 60,000 tons per year by 1971.[15] The French firms Compagnie de Products Chimiques et Electrometallurgiques Péchiney and Ugine-Kuhlmann signed an agreement with the Government to form a company to investigate bauxite deposits in an area between Tibati and Ngaoundéré.[16] The BRGM studied these deposits in 1958 and estimated reserves of bauxite at 500 million tons; however, recent investigations indicate reserves of about 1 billion tons of bauxite

[12] World Mining. What's Going On In World Mining. V. 5, No. 9, August 1969, pp. 58–59.

[13] Prepared by Henry E. Stipp.

[14] Where necessary, values have been converted from Communauté Financiere Africiane Francs (CFAF) to U.S. dollars at the rate of CFAF248=US$1.00.

[15] Engineering and Mining Journal. V. 171, No. 2, February 1970, p. 82.

[16] Metal Bulletin (London). Bauxite Prospects in Cameroon. No. 5446, Nov. 4, 1969, p. 16.

Table 5.—Cameroon: Production of mineral commodities

Commodity [1]	1967	1968	1969
Aluminum, metal, primary metric tons	48,324	45,391	46,737
Gold, mine output, metal content—troy ounces	991	r 965	177
Tin, mine output, metal content—long tons	51	41	29

r Revised.

[1] In addition to commodities listed, construction materials such as clays and sand and gravel are produced but quantitative data for these are not available.

Table 6.—Cameroon: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968 [1]
METALS		
Aluminum, metal	49,543	[2] 34,419
Copper, scrap	------	42
Iron and steel, metal, scrap	845	982
Tin, ore and concentrate long tons	------	49
Nonferrous ore and concentrates, n.e.s.	52	63

[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1968, pp. 592–594.

[2] Principal destinations: France 29,963; the Netherlands 2,457.

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Table 7.—Cameroon: Imports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968 [1]
METALS		
Aluminum, metal	4,724	1,347
Copper, metal	82	70
Iron and steel:		
Pig iron and ferroalloys	186	NA
Steel ingots and equivalent forms	496	601
Semimanufactures:		
Bars, rods and sections	9,128	13,351
Plate, sheet and strip	10,140	8,307
Rails and accessories	NA	743
Wire	2,300	2,324
Tubes, pipes and fittings	7,749	13,941
Total	29,317	38,666
Lead	59	NA
NONMETALS		
Abrasive, natural	202	NA
Barium sulfate	1,356	NA
Cement, lime, etc	134,535	137,505
Clays and clay products	2,764	3,538
Fertilizer materials, manufactured	30,118	49,848
Salt	22,032	-------
Stone and sand and gravel	151	-------
Nonmetallic minerals, crude, n.e.s	24,889	22,395
Nonmetallic mineral manufactures, n.e.s	-------	-------
Pigments, paints	1,320	98
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	69,077	49,562
Tar, pitch and other crude chemicals from coal, oil, and gas distillation	3,036	8,006

NA Not available.

[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 8, 1968, pp. 595–608.

reportedly containing 43 to 44 percent alumina (Al_2O_3) and 3.4 percent silica (SiO_2).

Mineralogical studies of bauxite found near Minim-Martap indicated an average alumina content of 42 to 43 percent.[17] The deposits are located in the remote northern part of Cameroon. If the deposits prove to be feasible for commercial development, the proposed Douala to Fort Lamy, Chad railway could be diverted to pass through the area. In October the Government announced the formation of a company, Société d'Etudes des Bauxites du Cameroun, to investigate the bauxite deposits at Mini Martap. The Cameroon Government has 40 percent of the shares of the company, with 60 percent being divided among Péchiney, Ugine-Kuhlmann, and BRGM. Studies planned by the company will cost about $1.1 million and are scheduled to last 3 years.

Copper deposits in the vicinity of Poli, south of Garoua, were being studied by BRGM to determine the extent of mineralization. The exploration area covers 3,667 square miles. Although results of the exploration program were unknown, reportedly Société Miniere de Peñarroya and Compagnie de Mokta were interested in participating in the program on a shared cost basis. The Cameroon Department of Mines was studying copper indications in the Lom series of schists east of Meiganga.[18] Copper anomalies in the Kodeala area were discovered to be uneconomic; however, in the Penti-Koti area mineralization of 0.18 to 2.5 grams per ton of copper were discovered.

Gold was mined in the Betare Oya area under Government issued mining permits. However, in the Batouri area, where gold also is found, no mining permits have been awarded. The mining and sale of gold in the Batouri area, which is estimated to be equal in quantity to that at Betare Oya, is undertaken illegally.

Reportedly, ore at the tin mine at Mayo Darle near the Nigerian border is almost exhausted. Additional ore reserves will have to be located or the mine will be shut down within the next few years.

A cement plant was being constructed at Figuil in northern Cameroon and a cement

[17] Belinga, Samuel. Composition Mineralogique des Bauxites de l'Adamaua (Cameroun). Annuals de la Faculté des Sciences du Cameroun, No. 2, 1968, pp. 59–76.

[18] Annales Des Mines (Paris). Cameroun. No. 9, September 1969, pp. 75–76.

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clinker factory was being erected at Douala. Both plants were expected to become operational in 1971.

Exploration for crude petroleum has intensified, but no commercially exploitable reserves have been discovered. No use has been found for the 14.1 billion cubic feet of natural gas discovered in the Douala area. In 1967 Société d'Etudes et de Recherches des Petroles du Cameroun (SEREPCA) drilled a well in their Rio del Ray offshore concession that found two oil and three gas reservoirs.[19] However, the find was considered to be noncommercial. Amerada-Hess Oil Co. and Cities Service Petroleum Co. were granted a petroleum exploration concession for an offshore area extending between the town of Campa and the Equatorial Guinea border.[20] The companies agreed to start seismic work speedily and to begin drilling within 1 year or surrender the concession.

Standard Oil Co. of New Jersey (ESSO) is building a chain of service stations throughout the country, which now total 11 stations.

CENTRAL AFRICAN REPUBLIC [21]

Diamond mining was the principal activity of the mineral industry in the Central African Republic (CAR). In recent years the sale of diamond has constituted about 50 percent of the CAR export revenue and was probably the most important activity in the monetized sector of the economy. Mining of uranium, which is expected to begin in 1972, will provide an additional source of revenue for the Government and increase employment by about 600 persons. However, the location of uranium deposits will require high transportation costs and the difficulty of extracting the uranium from its ores will also increase production costs.

The recovery of diamond in 1969 was valued at about $15.3 million, a decrease of 15 percent from the $18 million of 1968.[22] Production was estimated at roughly 60 to 65 percent gem stones and 35 to 40 percent industrial stones. Quantitative data on production and trade are shown in tables 8–9. Foreign trade in mineral commodities in 1968 consisted of mainly diamond exports, valued at $18.9 million, compared with $13.6 million in 1967. Principal imports of mineral commodities in 1968 were petroleum refinery products, valued at $938,000, and cement and building products, valued at $901,000. In 1967 imports of these commodities were valued at $855,000 and $984,000, respectively.

A joint venture company, Société Centrafricaine de Diamant Industriel, was formed to set up a diamond cutting and polishing factory and to export diamonds. The Government of CAR was to provide 51 percent of the company's capital. In October the National Diamond Office (OND) was closed by the Government. Offices of several diamond buying firms, including Diamond Distributors, Inc. (DDI), and CADIAM, both United States owned firms, also were closed. The OND and most company offices were reopened after the firms paid certain sums of money, allegedly owed as taxes, to the CAR treasury. A week later the Government demanded payment of overdue fees for the renewal of mining permits for three companies affiliated with DDI. The companies refused to pay the amount of money demanded by the Government and their operations, including mines, were again shut down. The dispute continued throughout the year, but was being negotiated by company officers and Government Ministers. The closedown of company operations was mainly responsible for the decrease of 13.5 percent in CAR output of diamond compared with that of

[19] Petroleum Intelligence Weekly. What's New Around the World. V. 8, No. 6, Feb. 10, 1969, p. 7.

[20] Petroleum Intelligence Weekly. Growing Offshore Play in West Africa is Speeding Up. V. 9, No. 5, Feb. 2, 1970, p. 5.

[21] Prepared by Henry E. Stipp.

[22] Where necessary, values have been converted from Communauté Financiere Africiane Francs (CFAF) to U.S. dollars at the rate of CFAF245=US$1.00 from Jan. 1, 1969 through Aug. 6, 1969; and CFAF277=US$1.00 from Aug. 7, 1969 through Dec. 31, 1969.

Table 8.—Central African Republic: Production of mineral commodities

	Quantity (carats)
Diamond (gem and industrial): [1]	
1967	520,628
1968	609,360
1969	526,906

[1] In addition, construction materials such as clays and sand and gravel were produced, but quantitative data were not available.

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Table 9.—Central African Republic: Foreign trade in selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968
EXPORTS		
NONMETALS		
Diamond ..... carats	513,184	[1] 635,936
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	434	NA
IMPORTS [2]		
METALS		
Aluminum	161	61
Copper	14	NA
Iron and steel, including alloys, semimanufactures	4,068	3,238
Lead	1	NA
Tin ..... long tons	2	NA
NONMETALS		
Abrasives, natural	20	NA
Cement, lime, and other building materials	20,742	15,728
Clay construction materials	145	NA
Fertilizer materials, manufactured	3,844	1,213
Nonmetallic mineral manufactures	4,266	13
Other crude minerals	22	NA
MINERAL FUELS AND RELATED MATERIALS		
Gas, natural or manufactured	352	NA
Petroleum refinery products	84,882	28,559

NA Not available.

[1] Principal destinations: United States 387,920; Israel 190,781.

[2] Source for 1968 figures: Republic Centrafricaine (Bangui). Monthly Bulletin of Statistics. No. 2, February 1969, pp. 5–18 (10 and 11 months, 1968).

the previous year. Also contributing somewhat to the decline in official diamond recovery statistics was an increase in smuggling operations.

The CAR Government signed documents for organizing a company which will exploit uranium deposits at Bakouma. The firm, Compagnie des Mines d'Uranium de Bakouma (URBA), which is owned by the French Atomic Energy Commission (CEA) (40 percent), Compagnie Française des Minerais d'Uranium (40 percent), and the CAR Government (20 percent), expects to produce 1,200 tons of uranium concentrate per year by 1972. The reserves, located in the Bakouma region 298 miles northeast of Bangui, between Kotto and M'Bari, were estimated at 3 million tons of ore containing about 8,000 tons of uranium (U_3O_8). Mineralization is localized in shale-phosphate sediments of Eocene age. The uranium is present in the form of autunite (calcium uranium phosphate) and torbernite (copper uranium phosphate).

CHAD [23]

Recovery of natron in the Lake Chad area and salt in the desert salt flats were again the principal commercial activities of the mineral industry. Unrecorded quantities of construction materials also were produced for local use. The following research program was scheduled to be conducted by the Bureau de Recherches Géologiques et Minières for the Chadian Government: (1) A survey of the salt deposits of the Borkou-Ennedi area; (2) prospecting of gold quartz veins of the Iriba region; and (3) prospecting for platinum and copper in the Lake Léré area. The Government also was active in encouraging exploration by foreign firms for minerals and mineral fuels. Technicians of the Food and Agricultural Organization (FAO) also were conducting hydrology studies in the Lake Chad basin.

The 3,870 tons of natron produced in 1969 was valued at about $70,321,[24] compared with 3,880 tons valued at $82,855 in 1968. Production, which was geared to sales in the Nigerian market, was lower as a result of the civil war in that country.

Chad's foreign trade in mineral commodities was confined mainly to the import of manufactured articles and export of natron as shown in table 10. In 1968 imports of cement were valued at $2.1 million, fuel oil $1.7 million, iron and steel

[23] Prepared by Henry E. Stipp.

[24] Where necessary, values have been converted from Communauté Financiere Africiane Francs (CFAF) to U.S. dollars at the rate of CFAF277=US$1.00.

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semimanufactures $618,000 and fertilizer $275,000.[25] In 1967 these commodities were valued at $741,000, $1.6 million, $97,000, and $243,000, respectively.

In September the Chad Government granted a 5-year permit for hydrocarbon exploration in central and southern Chad to Continental Oil Co. (CONOCO).[26] The exploration areas cover a total of 233,105 square miles in the Lake Chad Syncline and the Chari Depression. CONOCO must spend a total of $5.7 million during the 5-year period. The permit can be renewed for two 5-year periods. Provision also has been made for production if a commercial discovery is made.

Although minerals development in Chad is negligible, the country contains traces of tantalum, cassiterite, and tungsten in the Tibesti mountains in northern Chad, and alluvial gold, platinum, and copper deposits near Léré, southern Chad.[27]

Table 10.—Chad: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967 [1]	1968 [2]
EXPORTS		
NONMETALS		
Natron	3,683	•2,500
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	3,212	NA
IMPORTS		
METALS		
Aluminum	9	14
Copper	9	NA
Iron and steel, metal, semimanufactures	3,224	3,272
Lead	5	NA
Zinc	1	NA
NONMETALS		
Abrasives, natural	18	NA
Cement, lime, and other building materials	10,059	24,731
Clay construction materials	177	23
Fertilizers, manufactured	1,918	6,680
Nonmetallic minerals, crude, n.e.s.	2,178	NA
Nonmetallic mineral manufactures	30	28
MINERAL FUELS AND RELATED MATERIALS		
Gas, natural or manufactured	217	NA
Petroleum refinery products	41,887	351

• Estimate. NA Not available.

[1] Statistical Office of the European Communities, Associates. General and Foreign Trade Statistics. No. 6, 1968, pp. 39–49.

[2] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1968, pp. 561–567.

CONGO (BRAZZAVILLE) [28]

The mineral industry of Congo (Brazzaville) consisted mainly of crude petroleum recovery and output of small quantities of nonferrous metals. However, the mining of potash, which began in 1969, should enhance significantly the total value of mineral production in future years.

The Congolese Government was active in encouraging foreign private investment in the industrial sector. Although the United States currently has no diplomatic representation with Congo (Brazzaville), an Investment Guaranty Agreement has been signed by the two countries. Hydrology studies in the Sangha region, which were being conducted by the Overseas Office of Scientific Research and Technology (ORSTOM), were terminated.

Production statistics for 1969 were not available. Petroleum output, which has been decreasing steadily since 1964, probably fell again. The small field at Pointe Indian is approaching exhaustion.

Foreign trade in mineral commodities outside of the Central African Customs and Economic Union in 1968 consisted mainly of exports of diamond valued at $15.5 million, nonferrous ore and concentrates valued at $1.8 million, and crude petroleum and refinery products valued at $646,000.[29] In 1967 these commodity exports were valued at $16.1 million, $1.0

[25] Statistical Office of the European Communities. General and Foreign Trade Statistics. 1969–4, p. 19.

[26] U.S. Embassy, Fort Lamy. State Dept. Airgram A–135 Sept. 11, 1969, p. 2.

[27] Worrel, Stephen W. Basic Data on the Economy of Chad. U.S. Dept. of Commerce. Overseas Business Reports, July 1969, p. 6.

[28] Prepared by Henry E. Stipp.

[29] Where necessary, values have been converted from Communauté Financiere Africiane Francs (CFAF) to U.S. dollars at the rate of CFAF247=US$1.00.

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Table 11.—Republic of Congo (Brazzaville): Production of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967 [1]	1968 [2]	1969 [e]
METALS [3]			
Copper	906	[r] 783	800
Gold, troy ounces	[2] 5,048	4,790	5,000
Lead	1,408	3,194	3,000
Tin, long tons	[2] 71	24	20
Zinc	[r] 6,368	929	900
NONMETALS			
Potash	-------	------	24,000
MINERAL FUELS AND RELATED MATERIALS			
Petroleum, crude	[2] 50,011	42,558	35,000

[e] Estimate. [r] Revised.
[1] International Monetary Fund. Surveys of African Economics. V. 1, 1968, p. 237.
[2] Statistical Office of the European Communities, Associates. General and Foreign Trade Statistics. 1969–4, p. 22.
[3] Mine output, metal content.
[4] Annales Des Mines, September 1969, p. 77.

million, and $711,000, respectively. Imports of mineral commodities in 1968 were mainly iron and steel semimanufactures valued at $8.8 million, petroleum products valued at $1.3 million, and cement valued at $537,000. In 1967 these imports were valued at $8.5 million, $2.0 million, and $1.3 million, respectively.[30]

The Compagnie des Potasses du Congo (CPC) mine at Holle produced about 2,000 tons per day of potash ore.[31] Output was expected to reach 5,600 tons per day by March 1970. Reportedly, production has been delayed by the irregular beds, which slow the continuous mining machines at gradients above 2 percent. According to CPC, potash yield from the flotation process is 39 percent, highest in the world. The CPC installation employed 700 Congolese workers and 200 European staff employees.

Elf-Congo, a subsidiary of Enterprise de Recherches et d'Activitiés Petrolières (ERAP), together with the Congolese Government and Elf-Spafe, discovered crude oil in a wildcat well located 15 miles from the coast near the border with Cabinda.[32] Several oil-bearing sands were found between depths of 1,820 feet and 1,970 feet. Four other producing wells were drilled, indicating significant reserves; however, the field is located in water 197 feet deep, lacks gas pressure, has highly viscous crude, and has low output per well.[33] The

[30] Statistical Office of the European Communities, Associates. General and Foreign Trade Statistics. 1969–4, p. 22.
[31] U.S. Embassy, Kinshasa. State Dept. Airgram A–356, 2 pp.
[32] Petroleum Intelligence Weekly. V. 8, No. 17, Apr. 28, 1969, p. 7.
[33] Petroleum Intelligence Weekly. V. 9, No. 10, Mar. 9, 1970, p. 5.

Table 12.—Republic of Congo (Brazzaville): Exports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967 [1]	1968 [2]
METALS		
Iron and steel, including alloys, metal:		
Scrap	1,222	NA
Semimanufactures	478	NA
Copper	4,267	6,984
Lead	15	NA
Tin, long tons	[r] 85	NA
Zinc	9,723	NA
Nonferrous and concentrate	14,113	19,185
Nonferrous scrap	56	140
NONMETALS		
Diamond, gem, thousand carats	4,154	4,343
Cement, lime, and building materials	55	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude	38,400	35,257
Refinery products	11,846	NA

[r] Revised. NA Not available.
[1] Statistical Office of the European Communities, Associates. General and Foreign Trade Statistics. No. 6, 1968, pp. 113–117.
[2] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1968, pp. 568–570.

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Table 13.—Republic of Congo (Brazzaville): Imports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967 [1]	1968 [2]
METALS		
Aluminum	138	173
Copper	32	48
Iron and steel, including alloys, metal:		
Unwrought	1	NA
Semimanufactures:		
Bars, rods, and sections	6,612	4,291
Plate, sheet, strip, hoop	6,409	3,250
Rails and accessories	10,350	3,095
Tubes, pipes, fittings	3,296	2,931
Other	189	622
Total	26,856	14,189
Lead	15	NA
Tin, long tons	4	NA
Zinc	9	NA
NONMETALS		
Abrasives, natural	30	NA
Cement, lime, and building materials	67,779	23,883
Clay construction materials	1,644	1,177
Fertilizer materials:		
Natural	148	NA
Manufactured	5,607	NA
Stone and sand and gravel	176	NA
Sulfur and pyrite	NA	1,800
Nonmetallic minerals, crude, unspecified	2,040	1,312
Nonmetallic mineral manufactures	635	640
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke, and briquets	103	NA
Petroleum refinery products	122,426	7,249
Gas, natural and manufactured	773	NA
Tar, pitch and other crude chemicals from coal, oil, and gas distillation	5	NA

NA Not available.

[1] Statistical Office of the European Communities, Associates. General and Foreign Trade Statistics. No. 6, 1968, pp. 103–112.

[2] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1968, pp. 571–580.

Elf-Congo Company was evaluating the economic feasibility of developing commercial production from the field. Agip Recherches Congo SA, a subsidiary of the Italian company AGIP-SPA, and the Congolese Government, were preparing to drill two wildcat wells, one 9 miles offshore, and the other 50 miles offshore from Pointe Noire.[34]

DAHOMEY [35]

No recorded minerals were produced in Dahomey in 1969. The country has crude oil reserves of about 20 million barrels,[36] but they have not yet been developed. Union Oil Company of Dahomey found the oil offshore in 1968. Additional drilling in 1969 reportedly indicated that the reserves can be developed commercially.

EQUATORIAL GUINEA [37]

Mineral activity in Equatorial Guinea continued to be limited to petroleum exploration. This reportedly was curtailed for several months during the middle of the year because of political disagreements between the Governments of the country and Spain.[38] No commercial oil discoveries were made during the year.

In late 1969 Continental Oil Co. (CONOCO) acquired 50-percent interest in the 1.2 million-acre concession held by Spanish Gulf Oil Company and Compania Española de Petróleos, S.A., in the province of Rio Muni. The two companies each retained a 25-percent interest in the concession, which covers offshore and onshore

[34] Petroleum Review. V. 24, No. 280, April 1970, p. 85.

[35] Prepared by Eugene R. Slatick.

[36] Oil and Gas Journal. V. 67, No. 52, Dec. 29, 1969, p. 95.

[37] Prepared by Eugene R. Slatick.

[38] World Petroleum. V. 40, No. 12, November 1969, p. 46.

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areas. CONOCO, the operator for the group, is to invest $2 million in 1970 for exploration and for drilling one well.

Chevron Oil Company of Equatorial Guinea was awarded a concession off Fernando Po. Spanish Gulf Oil Company and Mobil Producing Spain, Inc., have offshore concessions in the area. Both companies found traces of oil and gas in past exploratory drilling.

ETHIOPIA [39]

There were no economically significant mineral developments in Ethiopia in 1969, and the mineral industry continued to be of minor importance to the economy. Mineral exploration centered on potash and petroleum. A draft law governing mining was under study by the Council of Ministers; it had been approved by various governmental committees.

Late in the year the Ethiopian Potash Co. (Kaiser Aluminum & Chemical Corp. and Seatankers, Inc.) reported that the drilling phase of its operations will end in January 1970. The company is to decide when to start a pilot plant for producing potash. Because of the low prices for potash on the world market, the plant is not expected to be built for several years.

In late November the Mobil-Esso joint venture found natural gas 6.5 miles offshore, about 75 miles north of Massawa. The well, which was drilled in 210 feet of water, struck the gas deposit at a depth of 9,700 feet. The gas was under high pressure and blew out of control, so the well was permanently capped to prevent further eruptions. The commercial possibilities of the discovery were not reported, but the find is viewed as encouraging because of its size. The discovery well was the second well drilled by Mobil; the first, drilled in 1966, was dry.

In July, Tenneco Ethiopia, Inc., obtained exploration rights to a 76,380-square-mile area in the south-central part of the country, west of the Ogaden Desert. Exploratory operations began late in the year.

A fertilizer plant with a capacity of at least 5,000 tons per year is to be built at Massawa or Assab, both on the coast.[40] The plant, which cost about $560,000 will use imported materials.

A galvanized sheet plant operated by an Ethiopian-Indian company began operations late in the year near Asmara.[41] The

[39] Prepared by Eugene R. Slatick.
[40] Nitrogen. No. 57, January–February 1970, p. 7.
[41] Metal Bulletin. No. 5439, Oct. 10, 1969, p. 27.

Table 14.—Ethiopia: Production of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
METALS				
Gold, mine output, metal content	troy ounces	22,943	38,828	42,400
Manganese, ore and concentrate		e2,000	--	--
Platinum, mine output, metal content	troy ounces	282	349	348
NONMETALS				
Cement	thousand tons	150	174	166
Clays, kaolin		7,540	13,000	12,497
Feldspar		3,750	7,130	11,643
Gypsum and anhydrite, crude		6,103	360	5,191
Lime		22,837	22,735	17,980
Limestone		132,033	147,155	106,121
Salt:				
Rock	thousand tons	10	12	13
Marine	do.	250	250	250
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Motor gasoline	thousand 42-gallon barrels	296	603	555
Jet fuel	do.	10	119	188
Distillate fuel oil	do.	301	929	948
Residual fuel oil	do.	NA	1,251	1,377
Liquefied petroleum gas	do.	3	23	29
Asphalt	do.	18	90	70
Total	do.	NA	3,015	[2]3,190

e Estimate. NA Not available.
[1] Includes Eritrea.
[2] Includes 23,000 barrels of kerosine.

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Table 15.—Ethiopia: Foreign trade in selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968
EXPORTS		
NONMETALS		
Salt	156,480	159,524
IMPORTS		
METALS		
Aluminum, metal	586	1,010
Copper, metal	226	120
Iron and steel, metal:		
Pig iron and ferroalloys, scrap	7,965	1,772
Semimanufactures:		
Bars	4,156	3,769
Plate and sheet	20,723	17,447
Hoop and strip	3	5
Tubes, pipes, and fittings	53,563	8,022
Wire	3,415	2,698
Rails and accessories	1,319	548
Castings and forgings	104	402
Total	83,283	32,891
Zinc, metal	322	576
NONMETALS		
Clays and clay products	1,381	1,299
Lime, cement, and other construction materials	2,709	1,876
Sulfur	71	215
MINERAL FUELS AND RELATED MATERIALS		
Coal	765	4,823
Petroleum:		
Crude—thousand 42-gallon barrels	1,091	4,510
Refinery products—do	1,975	454
Tar, pitch and other crude chemicals from coal, oil, and gas distillation	105	1,114

output, initially 500 to 600 tons per month, is expected to be about 1,500 tons per month. There is a 30,000-ton-per-year galvanized sheet plant near Addis Ababa that is operated by Sabian Metal Products, Ethiopia, an Ethiopian-Japanese venture. The plant galvanizes and corrugates sheets imported from Japan.

THE FRENCH TERRITORY OF THE AFARS AND ISSAS [42]

There was no recorded production of mineral commodities; however, small quantities of stone and sand and gravel were probably produced for local consumption. Activity in mineral commodities was confined to trade. In 1968 the territory imported mainly iron and steel semimanufactures valued at $279,000; petroleum products valued at $207,000; and cement, lime, and building materials valued at $118,000.[43] In 1967 these commodities were valued at $389,000, $594,000, and $182,000, respectively.

Table 16.—The French Territory of the Afars and Issas: Imports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968 [1]
METALS		
Iron and steel, metal:		
Castings and forgings	r 126	NA
Semimanufactures	1,851	1,363
NONMETALS		
Cement, lime, etc	r 5,870	4,272
Nonmetallic minerals, crude, unspecified	r 207	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude and partly refined	r 1,397	NA
Refinery products	r 11,963	505

r Revised. NA Not available.
[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1968, pp. 188-192.

[42] Prepared by Henry E. Stipp.
[43] Where necessary values have been converted from Djibouti Francs (DF) to U.S. dollars at the rate of DF1=US$0.466.

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GAMBIA [44]

There was no recorded production of mineral commodities; however, small quantities of clays, stone, and sand and gravel were produced for local consumption. Kaolin deposits were discovered 10 miles from Basse Santa Su.[45] The Gambian Government was organizing a survey to assess the size of the deposits in order to determine whether a ceramic industry could be established. The Government also was investigating possible deposits of ilmenite.[46] Mineral activity in Gambia was confined mainly to trade. In 1968 imports (as shown in table 17) consisted mainly of cement and building products valued at $319,000, iron and steel semimanufactures valued at $278,000, and petroleum and petroleum products valued at $210,000.[47] In 1967 these commodities were valued at $245,000, $766,000, and $175,000, respectively.

Table 17.—Gambia: Foreign trade in selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968 [1]
EXPORTS		
METALS		
Copper, metal, unwrought	279	NA
MINERAL FUELS AND RELATED MATERIALS		
Crude petroleum	389,117	NA
IMPORTS		
METALS		
Copper, alloys, worked	24	NA
Iron and steel, semimanufactures	2,211	1,157
NONMETALS		
Cement	8,664	15,092
Fertilizers, manufactured	5,109	3,184
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	4,542	2,407
Bitumen	941	1,415

NA Not available.
[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1968, pp. 341–345.

GUINEA [48]

Bauxite and alumina continued to be the only minerals produced in Guinea for which data were available. The total bauxite production includes about 1,859,000 tons mined by Compagnie International pour la Production de l'Alumine (FRIA) at Kimbo and about 600,000 tons mined by Harvey Aluminum, Inc., at Tamara Island. As in past years, FRIA's production was converted into alumina, and Harvey's was exported to its plant in the Virgin Islands. FRIA's plant was being expanded to enable alumina production to reach 700,000 tons in 1970.

Construction work on the railroad, port, and related facilities of the Boké Bauxite Project began in October. The $182.5 million project was scheduled to begin bauxite production in 1972 at an initial rate of 6.6 million tons per year, raising Guinea's total bauxite output to about 9 million tons. The Boké deposits are estimated to contain several hundred million tons of bauxite. They are being developed by Compagnie des Bauxites de Guineé (CBG), a joint venture comprised of the Government (49 percent) and Halco Mining, Inc. (51 percent).

During the year representatives of five of Japan's aluminum smelters visited Guinea to determine the possibility of securing a future source of bauxite. Late in the year Soviet and Guinean officials discussed the possibility of jointly exploiting bauxite deposits at Kindia, about 100 kilometers from Conakry.

Exploratory drilling in the iron ore deposits on the Guinean side of the Nimba Mountains was done during the year by Liberian American Swedish Minerals Company (LAMCO) with the help of a $1 million loan from the World Bank. The results indicate reserves of about 300 million tons of ore averaging 66 percent iron.

[44] Prepared by Henry F. Stipp.
[45] Standard Bank Review (London). The Gambia. June 1970, p. 19.
[46] Standard Bank Review (London). The Gambia. April 1970, p. 22.
[47] Where necessary, values have been converted from Gambian Pounds (£G) to U.S. dollars at the rate of £G1=US$2.40.
[48] Prepared by Eugene R. Slatick.

Table 18.—Guinea: Production of mineral commodities

Commodity [1]	1967	1968	1969
Aluminum:			
Bauxite, gross weight thousand metric tons	1,639	2,118	2,459
Alumina, gross weight—metric tons	529,980	530,861	572,460

[1] Diamond and gold are also produced, but data are not available.

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Table 19.—Guinea: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
EXPORTS		
METALS		
Aluminum:		
Alumina	529,980	530,861
Bauxite	88,015	549,000
Iron and steel:		
Ore and concentrates	14,711	NA
Scrap	3,177	4,140
IMPORTS		
METALS		
Aluminum, metal, including alloys, all forms	546	873
Iron and steel, metal, semimanufactures	2,318	1,484
NONMETALS		
Cement, lime, etc	2,988	25,463
Fertilizers, manufactured	495	2,954
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products, thousand 42-gallon barrels	582	552

NA Not available.

A new company, Compagnie Minerale de Fer de Guineé (MIFERGUI), was established to develop the deposits. MIFERGUI is comprised of the Guinea Government (50 percent), Southland Mining of Australia (20 percent), United States Steel Corp. (12.5 percent), Finsider of Italy (7.5 percent), and the State-owned steel companies of Rumania and Yugoslavia (5 percent each).

Provisional plans envisage iron ore production at 15 million tons per year, using Liberia's railroads to transport the ore to its port of Buchanan. Okura Trading Company of Japan has agreed to import 7.5 million tons of iron ore per year. The remaining ore produced is to be exported to the companies in the MIFERGUI consortium in accordance with their investment shares.

During the year, Shell Oil Co. was granted a 17,000-square-mile concession covering the entire offshore area. The company carried out airborne magnetometer and marine seismic surveys. It also held negotiations regarding the construction of a 9,600-barrel-per-day petroleum refinery at Conakry for the Government.

IVORY COAST [49]

In 1969, as in the past several years, diamond was the Ivory Coast's most important mineral. Diamond production was valued at $4.3 million,[50] compared with $3.8 million in 1968. Manganese continued to be the only other mineral of economic importance. Production during the year was valued at $1.9 million, a slight rise from $1.7 million in 1968. Two other important sectors of the mineral industry were petroleum refining and cement manufacturing, both of which process imported materials. The output of petroleum products was valued at an estimated $19 million, and of cement, at $11.3 million. In 1968 exports of diamond and manganese were valued at $3.9 million and $1.7 million, respectively.

The country's three diamond mining companies and their shares of production in 1969 were Société Anonyme de Recherches et d'Exploitation Minières en Côte d'Ivoire (SAREMCI), 87 percent; Société Diamantifere de Côte d'Ivoire (SODIAMCI), 10 percent; and Société Minière des Bandamas (SMB), 3 percent.[51] The amount of material treated and the average yield for these companies during the year were as follows: SAREMCI, 522,505 cubic meters, at 0.34 carat per cubic meter (ccm); SODIAMCI, 101,412 cubic meters, at 0.20 ccm; and SMB, 18,950 cubic meters, at 0.30 ccm. SAREMCI had a development program underway that is expected to raise the annual production to about 200,000

[49] Prepared by Eugene R. Slatick.

[50] Where necessary, values have been converted from Communauté Financiere Africiane Francs (CFAF) to U.S. dollars at the rate of CFAF1=US$0.0041. The franc was devalued in August to the rate of CFAF1=US$0.0036.

[51] Frost, P.F. Mineral Production Statistics Questionnaire. State Dept. Airgram A-51, Mar. 20, 1970, 8 pp. (This report provided information for several parts of this subchapter.)

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Table 20.—Ivory Coast: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Columbium and tantalum, ores and concentrates, gross weight, kilograms	-----	632	211
Gold, metal, troy ounces	116	84	-----
Manganese, ore and concentrate, gross weight	149,433	116,741	127,089
NONMETALS			
Cement, thousand tons	256	330	388
Diamond:			
Gem, carats	r • 70,330	r • 77,009	• 81,413
Industrial, do	r • 105,495	r • 110,000	• 121,000
Total, do	175,825	187,009	202,413
MINERAL FUELS AND RELATED MATERIALS			
Gasoline, motor, thousand 42-gallon barrels	1,251	1,358	1,354
Kerosine and jet fuel, do	579	625	625
Distillate fuel oil, do	1,341	1,470	1,613
Residual fuel oil, do	1,516	1,544	1,730
Liquefied petroleum gas, do	106	128	123
Total, do	4,793	5,125	[1] 5,481

• Estimate. r Revised.
[1] Includes 86,000 barrels of lubricants.

Table 21.—Ivory Coast: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, all forms	373	392
Copper, metal, including alloys, all forms	1,061	774
Iron and steel, metal:		
Scrap	4,441	9,716
Semimanufactures	514	527
Lead, metal, including alloys, all forms	366	600
Manganese, ore and concentrate	105,587	132,990
NONMETALS		
Cement	10,902	15,640
Diamond, carats	178,516	189,753
Fertilizer materials, manufactured	1,982	942
Salt	2,854	1,905
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products, thousand 42-gallon barrels	1,410	2,080

Table 22.—Ivory Coast: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, all forms	2,246	501
Copper, metal, including alloys, all forms	142	178
Iron and steel, metal, semimanufactures	r 58,486	66,761
Lead, metal, including alloys, all forms	191	98
Zinc, metal, including alloys, all forms	128	78
NONMETALS		
Cement	264,602	27,385
Chalk	368	558
Clay products (including all refractory bricks)	109	105
Fertilizer materials	21,083	22,594
Gypsum	8,931	12,097
Lime	3,014	2,805
Salt	24,175	22,574
Stone and sand and gravel	3,151	3,070
Talc steatite	409	594
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	198	496
Petroleum:		
Crude, thousand 42-gallon barrels	4,963	5,257
Refinery products, do	119	2,050

r Revised.

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carats. SMB reported that its reserves were almost depleted and that production is expected to stop in 1970. Société West African Selection Trust et Harry. Winston (WASTON) had not begun production as was anticipated; work was underway so that operations could start early in 1971.

Low prices for manganese on the world market forced Compagnie de Mokta, the country's only manganese producer, to stop operations in March 1970. The manganese output, which rose in 1969, will be stockpiled at the port of Abidjan.

Low prices also caused tantalum mining to stop during the year. The mining was done in the Issia region by artisans under the supervision of Société pour le Développement Minier de la Côte d'Ivoire (SODEMI).

Pickands Mather & Company continued to evaluate the iron ore deposits on its concession area in the western part of the country. The studies, which are to continue through at least 1970, reportedly indicate that the reserves are sufficient for commercial operations.

The fertilizer plant of Société Ivoirienne des Engrais (SIVENG) was under construction during the year. Operations are expected to begin in late 1970.

In May the Government approved an agreement in principle for the formation of a petroleum consortium that is to be comprised of Esso Exploration Company, the Royal Dutch/Shell Group, and the French Government-controlled Enterprise de Recherches et d'Activites Pétrolières (ERAP). A formal agreement and a petroleum law are still to be prepared. The consortium is to be granted a 23,000-square-kilometer concession that covers the sedimentary basin along the coast. Indications of oil have been found in the area in the past, and recent geological evaluations indicate that the best oil prospects are offshore.[52]

The crude oil throughput at the refinery totaled about 5.7 million barrels, mostly Algerian crude oil. Lubricants are not made at the refinery. They are blended by Société Ivoirienne pour la Fabrication de Lubrifiants (SIFAL) and Lubrifiants Texaco. Texaco's plant began operations in November.

LESOTHO [53]

Diamond remained Lesotho's principal mineral commodity in 1969. All production continued to come from the Maluti Mountains. The output during the year was valued at $1.6 million,[54] compared with $527,000 in 1968. The sharp increase in 1969 reflects the resumption of full-scale mining operations and does not represent a higher rate of production. A comparison with the 1967 value of $1.4 million puts the 1969 value in a better perspective. Diamond production and exports are essentially the same.

During the year Bethlehem Steel Corp. joined Rio Tinto-Zinc Corp. (RTZ) in prospecting for diamond at Letseng-la-Terai. RTZ reported that prospecting results were encouraging; an exploratory adit was being drilled. If a diamond mining company is formed, Bethlehem Steel Corp. will have a 20-percent interest. If Lesotho National Development Corp. (LNDC) exercises its right to acquire a share in such a company, it would receive 25 percent, leaving RTZ with 55 percent.

Another company, London and Rhodesian Mining and Land Co. (LONRHO), received permission to prospect for 2½

[52] Rondot, Jean. Offshore Ivory Coast Still Holds Exploration Promise. Oil and Gas Internat., v. 9, No. 12, December 1969, pp. 72–73 and 91.
[53] Prepared by Eugene R. Slatick.
[54] Where necessary, values have been converted from South African Rand (R) to U.S. dollars at the rate of R1=US$1.40.

Table 23.—Lesotho: Production of mineral commodities

Commodity		1967	1968	1969
Diamond:				
Gem	carats	4,682	1,604	NA
Industrial	do	17,055	10,310	NA
Total	do	21,737	11,914	[1] 29,787

NA Not available.
[1] Exports.

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years in an 85-square-mile area in the Mokhotlong District. The company is to spend at least $350,000 annually. If mining is started, the company is to spend at least $5.6 million in development work. Furthermore, LNDC will have the right to acquire a 25-percent share in the operation. Other terms of the agreement include a company profit tax of 50 percent. Other companies were reported to be interested in obtaining prospecting areas.

The Government hopes to legalize diamond digging at Kao and Lighobong by issuing licenses to the diggers. It intends to provide licensed diggers with credit for purchasing equipment and with a diamond valuator.

During the year the Southern Oil Exploration Corp. (SOEKOR) of South Africa announced that it plans to explore for oil in Lesotho. The company was looking for an international oil exploration company to assist it.

Included in the development plans of LNDC are a small fertilizer blending and bagging plant and a gem stone processing plant.

In 1969, an average of 59,824 Basotho tribesmen worked in the mines of South Africa. This compares with 56,828 in 1968 and 75,331 in 1967. The total number each year depends on the employment conditions in Lesotho; in a poor agricultural year the number is high.

To encourage foreign investment, the Government enacted the Pioneer Industries Encouragement Bill in 1969. The bill provides tax exemptions and other incentives.

MALAGASY REPUBLIC [55]

The mineral industry of the Malagasy Republic continued to grow generally, although the value of mineral output was small. Graphite and mica were the principal minerals mined; however, the diversity of minerals output expanded with the addition of chromite after a lapse of several years.

The Malagasy Government policy of attracting foreign investment capital through the granting of liberal financing, tax, tariff, and mineral concession terms, continued to work successfully. Several foreign mining and petroleum companies were conducting exploration in Malagasy and its offshore areas, spurred by indications of copper, nickel, bauxite, and petroleum. International agencies such as the Bureau de Récherches Géologique et Minières (BRGM) conducted mineral research studies on its own and in cooperation with other international organizations such as the United Nations Development Programme, the European Development Fund, and the Fonds d'Aide et de Coopération.

PRODUCTION AND TRADE

Quantitative data on production and foreign trade are reported in tables 24–26. Total value of metals and minerals production (excluding petroleum refinery products) was about $2.4 million, compared with $2.3 in 1968.[56] Foreign trade in mineral commodities in 1968 consisted mainly of exports of iron and steel semimanufactured products, valued at $6.7 million; petroleum refinery products, valued at $4.0 million; and graphite, valued at $1.7 million. In 1967, these mineral exports were valued at $6.9 million, $4.0 million, and $1.8 million, respectively.

Principal mineral commodity imports in 1968 were iron and steel semimanufactured products, valued at $6.8 million; fertilizer materials, valued at $1.9 million; and cement, valued at $1.7 million. In 1967 these mineral imports were valued at $5.9 million, $1.1 million, and $1.3 million, respectively.

Compagnie Minière d'Andriamena (COMINA) operated a 550-ton-per-day washing plant near its chromite deposits at Bemanevika and Ankazataolana, about 80 miles northwest of Tamatave.[57] Reportedly, reserves of ore in the area, containing an average 42 percent chromium oxide (Cr_2O_3) total about 5 million tons. After crushing and washing, the ore has been upgraded to 50 to 52 percent Cr_2O_3, 12 to 15 percent magnesium oxide (MgO) and aluminum oxide (Al_2O_3), respectively; 20 percent iron oxide and matrix; and 3 percent silica (SiO_2). The company planned to strip 552,000 tons per year of overburden from the open pit mine and produce

[55] Prepared by Henry E. Stipp.
[56] Where necessary, values have been converted from Malagasy Francs (FMG) to U.S. dollars at the rate of FMG248=US$1.00.
[57] World Mining. New Chromite Mine and Washing Plant Readied for Production. V. 5, No. 3, March 1969, p. 17.

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Table 24.—Malagasy Republic: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1967	1968	1969
METALS			
Beryl concentrate, gross weight	30	77	75
Bismuth concentrate, gross weight, kilograms	------	40	NA
Chromite, gross weight	------	------	44,775
Columbite and tantalite, ores and concentrates, gross weight, kilograms	67	1,354	------
Gold, mine output, metal content, troy ounces	752	543	646
Rare-earth minerals:			
Bastnaesite concentrates, gross weight	165	254	[2]
Betafite ores, gross weight, kilograms	101	1,088	261
Euxenite ores, gross weight, do	84	------	22
Monazite concentrates, gross weight	25	[2]	[2]
Titanium, ilmenite concentrate, gross weight	1,857	------	------
Uranium and thorium, uranothorianite, concentrate, gross weight [3]	307	e r 95	------
Zirconium, concentrate, gross weight	209	------	------
NONMETALS			
Cement, hydraulic, thousand tons	60	68	75
Clays (kaolin)	120	620	NA
Garnet:			
Abrasive	[2]	50	[2]
Ornamental	5	4	7
Graphite, all grades	14,890	16,430	17,114
Mica, phlogopite:			
Block	54	78	62
Splittings	482	725	1,006
Scrap	205	103	114
Quartz, crystal	86	71	123
Salt, marine, thousand tons	14	17	22
Stone:			
Agate	4	2	2
Amazonite	4	9	2
Aragonite	102	470	488
Jasper, kilograms	3,300	402	140
Ornamental	12	r 10	13
Stones, semiprecious, kilograms	164	336	3,071
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous, thousand tons	2	------	NA
Petroleum refinery products:			
Gasoline, motor, thousand 42-gallon barrels	NA	865	634
Kerosine and jet fuel, do	NA	372	272
Distillate fuel oil, do	NA	809	731
Residual fuel oil, do	NA	e 1,004	------
Liquefied petroleum gas (LPG), do	NA	70	30
Total refinery products, do	NA	e 3,120	1,667

e Estimate. r Revised. NA Not available.

[1] In addition to commodities listed, a variety of other minerals, mainly nonmetallic, are produced in very small quantities.

[2] Less than ½ unit.

[3] Exports.

Table 25.—Malagasy Republic: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Beryl concentrate	26	57
Copper, metal, including alloys:		
Scrap	196	181
Semimanufactures	1	1
Iron and steel:		
Scrap	4,837	131
Semimanufactures	2,002	1,574
Lead, metal, including alloys, scrap	13	3
Tin, metal, including alloys, all forms, long tons	2	------
Uranium and thorium, ore and concentrate, including rare-earths	829	NA
Zinc, metal, including alloys, all forms	3	2
Other, ore and concentrate	146	------
NONMETALS		
Garnet, abrasive	29	25
Cement, hydraulic	15	3
Graphite, natural	16,199	15,886
Lime	4	1
Mica, all forms	861	1,415
Precious and semiprecious stones except diamond, kilograms	48,476	118,538
Salt and brines	1,314	5,214
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products, thousand 42-gallon barrels	1,140	3,345
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1	------

NA Not available.

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Table 26.—Malagasy Republic: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, all forms	696	1,232
Copper, metal, including alloys, all forms	100	173
Gold, metal, unworked or partly worked, troy ounces	6,302	------
Iron and steel:		
Ore and concentrate	42	------
Metal:		
Scrap	649	58
Semimanufactures	35,638	44,499
Lead, metal, including alloys, all forms	213	575
Platinum, metal, including alloys, troy ounces	353	------
Silver, metal, including alloys, do.	1,247	17,683
Tin, metal, including alloys, all forms, long tons	15	9
Zinc, metal, including alloys, all forms	110	102
Other, metals, including alloys, all forms	4	19
NONMETALS		
Abrasives, natural, grinding and polishing wheels and stones	18	20
Cement	50,245	60,678
Chalk	315	462
Clays and clay products (including refractory brick):		
Crude clays, n.e.s	54	376
Products	291	157
Diamond, all grades, thousand carats	20	66
Fertilizer materials:		
Crude, phosphatic and other	415	642
Manufactured, ammonia	32	23
Gypsum and plasters	3,514	4,105
Lime	2,248	1,857
Magnesite	1	14
Mica, crude and worked, kilograms	120	------
Pigments, mineral, including iron oxides	22	23
Salt and brines	816	1,844
Sodium and potassium compounds, caustic soda	339	396
Stone and sand and gravel, dimension stone	2	NA
Sulfur:		
Elemental	2	16
Sulfur dioxide	3	6
Sulfuric acid	80	101
Talc, steatite, soapstone, and pyrophyllite, kilograms	32,003	59,352
Other nonmetals, n.e.s	3,150	7,653
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets	17,215	NA
Coke and semicoke	70	NA
Petroleum:		
Crude and partly refined	295,716	412,578
Refinery products:		
Gasoline, thousand 42-gallon barrels	135	117
Kerosine and jet fuel, do.	45	20
Distillate fuel oil, do.	81	57
Residual fuel oil, do.	63	6
Lubricants, do.	51	10
Liquefied petroleum gas, do.	4	------
Other, do.	20	104
Total, do.	399	314
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	27	72

NA Not available.

120,000 tons per year of chrome concentrates by 1971. The concentrates will go by truck over a new all weather road to Morarano and by railroad to the port of Tamatave. About 80 percent of the concentrates are scheduled to be shipped to France for consumption; 20 percent will be exported to other countries.

Bauxite deposits located near Manantenina reportedly total about 100 million tons of ore containing 40 percent aluminum. Exploitation of the deposits at the rate of 4 to 4.5 million tons per year would be economically feasible. Transportation and port construction studies would be required before a mine could be developed.

A cement plant that produced 60,000 tons in 1967 and 65,000 tons in 1968 is located at Amboanio. Operated by the Cement Company of Malagasy, the installation employs 450 workers. The company plans to increase production to 120,000 tons per year to supply the island's total requirement.[58]

[58] Industries Et Travaux D'Outremer (Paris). La Production de la Compagnie des Ciments Malgaches va Augmenter. No. 182, January 1969, p. 63.

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Societe Malgache d'exportation des calcaires de l'Ankaratra received several tax concessions from the Government to manufacture lime at Antsirabe.[59]

Eight oil companies were searching for petroleum in Malagasy in 1969. They comprised four United States firms, two French, one Italian, and one Israeli.

Negotiations conducted between affiliates of Compagnie Française des Petroles (CFP) and Texas Gulf Sulfur Co. (TGS) were concluded with an agreement for conducting petroleum exploration in Malagasy.[60] Cie. des Petroles Total Madagascar, the subsidiary of CFP, will be the operating company in a 12,352-square-mile area along the west coast of Malagasy offshore from Morondava. Borombe Exploration Co., the TGS affiliate, acquired a 20-percent interest in the permit area in exchange for an investment of $2.4 million in exploration work. The Malagasy Parliament ratified the agreement on petroleum exploration signed by Tenneco Inc. and the Government on July 22. Continental Oil Co. will obtain a 50-percent share of Société des Pétroles de Madagascar Antsalava concession by a work obligation that includes drilling one well, among other tasks. An agreement for a petroleum exploration permit was signed by the Malagasy Government and Eason Oil Co. on June 20. The Israeli National Oil Co. was granted a permit on May 13 for petroleum exploration offshore near Nossi-Be island and Diego Suarez along the northwest coast of Malagasy. Continental Oil Co., COPETMA, and Societa Per Azioni (AGIP) were expected to complete seismographic surveying by yearend.

According to a Malagasy press release, a local petroleum product marketing firm, AGIP, offered to sell 20 percent of its shares to the Malagasy Government. A proposal by the island of Réunion to build a petroleum refinery could persuade the Government of Malagasy to postpone its plan for expansion of the 12,000-barrel-per-day plant located near Tamatave.[61] The Malagasy refinery supplies petroleum products to the islands of Réunion and Maurtitius.

An agreement between the Malagasy Government and AGIP-Madagascar gave the Government a participation in the organization by disposing of 46 service stations and a depot on the coast near Mananjari, along with other investments.[62]

MALAWI [63]

The principal mineral development in Malawi's mineral industry in 1969 was the start of an expansion program that will eventually double the output of the cement plant of the Portland Cement Co. (Malawi) Ltd. Cement is the only mineral commodity produced in large quantity. The output in 1969 totaled 83,600 tons, a 51-percent rise over the 55,500 tons produced in 1968.

There were no reports indicating that R.W. Gunson (Exports) Ltd. mined sapphire and ruby during the year, as the company had planned in 1968. Malawi's bauxite deposits, near Mlanje, reportedly contain about 60 million tons of exploitable ore averaging about 42.7 percent Al_2O_3. A new company, Alumina Corp. of Malawi, was formed to study the feasibility of developing the deposits.

The country's resources of radioactive minerals will be evaluated by Oceanic Exploration and Development Corp., a United States firm. The company received a 2-year license to prospect over areas totaling about 3,400 square miles in the northern and southern parts of the country.

A license was granted during the year for the construction of a $700,000 [64] fertilizer plant, which is expected to be operating in 1970.

During the year, Oil Company of Malawi Ltd. (OILCOM) built a 2,400-barrel storage depot at Nkhata Bay. The company, which was formed in 1968, has a program to build service stations through-

[59] Industries Et Travaux D'Outremer (Paris). Afrique De L'Est. No. 193, December 1969, p. 1068.
[60] Industries et Travaux D'Outremer. Afrique De L'Est. No. 185, April 1969, p. 309.
[61] Petroleum Intelligence Weekly. Malagasy. V. 9, No. 9, Mar. 2, 1970, p. 7.
[62] Chronique Des Mines et de la Recherche Miniere (Paris). No. 388, November–December, 1969, p. 6.
[63] Prepared by Eugene R. Slatick.
[64] Where necessary, values have been converted from Malawi Pounds (M£) to U.S. dollars at the rate of M£1=US$2.40.

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out the country.

About 15 percent of Malawi's male population is employed in the mines of South Africa, Southern Rhodesia, and Zambia. Their remittances constitute a substantial source of foreign exchange for Malawi.

Table 27.—Malawi: Imports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, semimanufactures	315	58
Copper, metal, semimanufactures and alloys	77	39
Iron and steel, metal, semimanufactures	6,597	2,523
NONMETALS		
Clays and clay products (including all refractory brick)	520	269
Fertilizer materials, manufactured	816	10,741
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products, thousand 42-gallon barrels	• 460	NA

• Estimate. NA Not available.

MALI [65]

The Republic of Mali mineral industry, consisting of marble, limestone, salt, and gold output, accounted for a negligible part of the total economy. Gold production, which has been insignificant, was expected to increase sharply from operations at Yanfolila. In addition, Mali produces quantities of ceramic materials, bricks, granite, and cement for which statistics are not recorded. In May the Government of Mali enacted a new code of investments granting liberal tax and tariff terms to new industrial enterprises. In July a new mineral investment law and a new petroleum law were put into effect.

Production of mineral commodities are shown in table 28.

Table 28.—Mali: Production of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Gold, troy ounces	-----	---	82
NONMETALS			
Limestone	-----	-----	2,500
Marble	2,500	2,500	2,500
Salt	3,500	3,000	3,000

Trade in mineral commodities in 1968 consisted mainly of imports of iron and steel semimanufactures, valued at $2.9 million; petroleum and products at $2.7 million and cement, valued at $18 million.[66] In 1967 imports of these commodities were valued at $1.5 million; $3.9 million, and $2.2 million, respectively. Iron and steel came mainly from the U.S.S.R., France, and mainland China. Petroleum products came from Senegal, the Ivory Coast, and France. Two United States firms, Mobil Oil of West Africa and Texaco Africa Ltd., sell petroleum products throughout Mali. Exports of mineral commodities in 1968 consisted mainly of petroleum products, valued at $336,000, compared with $245,000 in 1967.

Uranium exploration was conducted by a West German consortium. The group's concessions are located in the Gao and

[65] Prepared by Henry E. Stipp.

[66] Where necessary, values have been converted from Mali Francs (MF) to U.S. dollars at the rate of MF493=US$1.00.

Table 29.—Mali: Exports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967 [1]	1968 [2]
METALS		
Iron and steel, including alloys, metal, scrap and ferroalloys	7	NA
NONMETALS		
Nonmetallic minerals, crude, n.e.s	r 678	439
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	1,113	1,285

r Revised. NA Not available.

[1] Statistical Office of the European Communities, Associates. General and Foreign Trade Statistics. No. 5, 1968, pp. 129–146.

[2] Republic of Mali. Annual Statistics of the Republic of Mali. May 1969, p. 181.

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Table 30.—Mali: Imports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1967 [1]	1968 [2]
METALS		
Aluminum	r 160	133
Copper	r 86	51
Iron and steel, including alloys, metal:		
Scrap and ferroalloys	22	NA
Semimanufactures	5,810	13,300
Lead	38	33
Nickel	------	4
Tin long tons	------	1
NONMETALS		
Cement, lime, and other building materials	29,972	26,008
Clay construction materials	423	NA
Fertilizers, manufactured	1,131	3,260
Salt, sulfur (not separated in source)	45,887	38,822
Stone and sand and gravel	r 625	40
Nonmetallic minerals, crude, unspecified	16,422	NA
Nonmetallic mineral manufactures	117	12
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	18	14
Gas, natural and manufactured	265	NA
Petroleum refinery products	82,386	74,260

r Revised. NA Not available.

[1] Statistical Office of the European Communites, Associates. General and Foreign Trade Statistics. No. 5, 1968, pp. 129–146.

[2] Republic of Mali. Annual Statistics of the Republic of Mali. May 1969, pp. 171–173.

Kayes regions. The Diamou Cement Plant, constructed by U.S.S.R. technicians, was completed in September. About 200 workers would be employed at yearend, when the plant was scheduled to begin operating.

Prospecting by French and U.S.S.R. organizations has revealed traces of uranium, copper, bauxite, iron ore, manganese, lithium, phosphates, gold, diamonds, and petroleum; however, none in sufficient quantity for exploitation.

MAURITANIA [67]

Although the mineral industry of the Islamic Republic of Mauritania consisted mainly of iron ore mining and the output of small quantities of monazite, salt, and building materials, possibilities exist for the production of other mineral commodities. The output of copper concentrates was scheduled to begin in 1970. Traces of crude petroleum off the coast of Mauritania indicate an increasing role in the economy for the minerals sector. Minerals research was being conducted principally by Bureau de Recherches Géologiques et Minières (BRGM) for its own organization and several other groups such as the Mauritanian Government, Société des Mines de Fer de Mauritania (MIFERMA), and Fonds Européen de Development. BRGM was making geologic maps of Mauritania on a scale of 1 to 1 million and geologic maps of two areas near Kaedi and Sélibaby on a scale of 1 to 200,000. It was conducting drilling programs for water near Fort Gouraud and Bou Lanouar, and prospecting for minerals near Akjoujt and Moudjeria. Reportedly prospecting for iron ore was carried out in the D'Ink region and for diamond in the Hodh region. Important indications of copper minerals have been found near Guimimaka and in the Oum Kadmar area.[68]

Quantitative data on production and foreign trade are listed on tables 31–33. Foreign trade in mineral commodities in 1968 consisted of mainly iron ore and concentrates, valued at $82.1 million; compared with $84.6 million in 1967.[69] Imports of mineral commodities in 1968 consisted of mainly iron and steel semimanufactures, valued at $2.7 million; and petroleum products, valued at $988,000. In 1967 these commodities were valued at $1.7 million and $964,000, respectively.

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[67] Prepared by Henry E. Stipp.

[68] World Mining. World Wide Mining Developments. V. 6, No. 7, June 25, 1970, p. 128.

[69] Where necessary, values have been converted from Communauté Financiere Africiane Francs (CFAF) to U.S. dollars at the rate of CFAF247=US$1.00.

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Table 31.—Mauritania: Production of mineral commodities

Commodity [1]	1967	1968	1969
METALS			
Iron ore and concentrate thousand metric tons	7,452	7,702	[2] 8,576
Rare-earth metals, monazite ore, gross weight metric tons	-----	570	600
NONMETALS			
Salt, marine (including other evaporated) * ----do----	600	600	600

* Estimate.
[1] In addition to commodities listed, construction materials such as gypsum, clays, and sand and gravel are produced, but quantitative data are not available.
[2] Shipments.

Table 32.—Mauritania: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967 [1]	1968
METALS		
Iron and steel:		
Ore and concentrate thousand tons	7,532	[2] 7,487
Metal, scrap	1,809	1,783
Tin ----------long tons	[2] 2	NA
NONMETALS		
Nonmetallic minerals, crude, unspecified	[3] 8,074	286
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	[3] 6,386	NA

NA Not available.
[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 8, 1968, p. 526.
[2] Principal destinations in thousand tons: United Kingdom 1,875, France 1,846, West Germany 1,805.
[3] Statistical Office of the European Communities. Foreign Trade. No. 5, 1968, pp. 114-126 (9 months 1967).

Table 33.—Mauritania: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968 [1]
METALS		
Aluminum	[2] 97	NA
Copper	94	NA
Iron and steel, metal, semimanufactures	[2] 8,775	14,826
Tin ----------long tons	[2] 19	NA
NONMETALS		
Cement, lime, etc	[2] 6,030	5,781
Clays and clay products	[2] 95	201
Fertilizers, manufactured	2,372	3,131
Pigments	111	86
Salt	1,992	NA
Stone and sand and gravel	[2] 41	NA
Other crude mineral products	1,911	NA
Nonmetallic mineral manufactures	[2] 62	NA
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	[2] 4	NA
Petroleum refinery products	[2] 34,102	28,044

NA Not available.
[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 8, 1967, pp. 527-531.
[2] Statistical Office of the European Communities. Foreign Trade. No. 5, 1968, pp. 114-126 (9 months 1967).

MIFERMA increased the output of its mines in the Fort Gaurand area over that of 1968 shipping 8,575,751 tons, principally to West European countries.[70] This was accomplished despite an accident to one of MIFERMA's trains that derailed 40 ore cars carrying 3,200 tons of ore delaying traffic for 3 days.[71] Two railroad trains per day, consisting of 175 ore cars of 96-ton capacity, travel 404 miles from the mines to Port Etienne. The Mauritanian Government and MIFERMA reached agreement on the rate and scope of the company's policy on Africanisation of the staff during the next 7 years.[72]

MIFERMA signed a contract with Hollandsche Aanneming Maatschappij NV of the Netherlands to dredge and deepen the harbor at Nouadhibou for ore boats of 52 feet draught.[73]

Société Minière de Mauritania (SOMIMA) continued to develop its copper mine and beneficiating plants located near Akjoujt.[74] The company was prospecting its deposit and reportedly was optimistic with results of the survey. Initial plans include mining about 6,000 tons per day of oxide ore by open pit mining methods.[75] Ore will be loaded by diesel powered shovels and hauled to the primary crusher by diesel trucks. This crusher will reduce the ore to minus-150-millimeter size. After crushing, the ore will be reduced to minus-2.36-millimeter size in a 19-foot Aerofall mill, mixed with 1 percent salt and 1.5 percent coke in a rotating mixing tube and heated in 12 indirectly fired furnaces. Calcined material will be reduced to 0.15 millimeter in conical ball mills and classified by cyclones. Overflow from the cyclones will be treated by parallel banks of flotation cells. Concentrate will be filtered and stockpiled for shipping. Tailings will be pumped to a pond, where water will be reclaimed and recirculated to the mill. If present plans are completed, the company will produce 20,000 tons of metal in concentrate form in 1970. A contract for sale

[70] Skillings' Mining Review. V. 59, No. 7, Feb. 14, 1970, p. 4.
[71] Industries Et Travaux D'Outremer (Paris). West Africa. No. 190, September 1969, p. 763.
[72] Mining Journal (London). V. 273, No. 6992, Aug. 22, 1969, p. 172.
[73] World Mining. What's Going on In World Mining. V. 6, No. 3, March 1970, pp. 57-58.
[74] Industries Et Travaux D'Outremer (Paris). West Africa. No. 188, July 1969, p. 597.
[75] U.S. Embassy, Nouakchott. State Dept. Airgram A-211, May 27, 1966, p. 10.

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of concentrates was signed by SOMIMA. Installation of a pipeline to provide water from Bennichab about 75 miles away was completed.

Mining of yttrium at Bou-Naga continued with the product being shipped to the Péchiney-Saint-Gobain plant at Rochelle, France.[76] Exploitable reserves were estimated at 1,200 tons of ore containing 4.4 percent of yttrium for each 3.3 feet of depth.

A desalinization plant with a production capacity of 105,900 cubic feet of pure water per day and 1,700 kilowatts of electricity was inaugurated in January.[77] The $4.5 million plant, which was financed by the French Fonds d'Aide et de Coopération (CFA), will provide fresh water for the town of Nouakchott.

The vessel Glomar North Sea drilled the first hole for Amoco Mauritania Petroleum Co. in water 285 feet deep, about 19 miles off the coast of Cap Timiris. The initial geophysical survey revealed an interesting structure in the southern part of the concession area.[78]

NIGER [79]

The mineral industry of the Republic of Niger consisted mainly of tin and gold mining and the production of cement and associated construction materials. Despite the negligible value of minerals output, compared with other segments of the economy, prospects for increased activity in mining are very promising. Production of uranium from deposits in the vicinity of Arlit, 155 miles northwest of Agadès, could develop into a steady source of revenue for the Government of Niger. Investment in uranium mining by Germany, Italy, and Japan, in addition to that of France, indicated the potential development of a major industry by world standards. Petroleum exploration in Niger by three United States firms could discover other significant mineral resources. The Government indicated that it would welcome investment from private industry in the development of Niger's mineral resources. Exploration for mineral resources was being carried out by the United Nations Development Program, the French Atomic Energy Commission (CEA), and the Food and Agriculture Organization (FAO). An FAO drilling crew discovered considerable underground water in the Dallol Maouri valley between Gaya and the Nigerian border. A mineral study of South Maradi and Danagarim—Mounio was being conducted under a grant by the French Fonds d'Aide et de Coopération (CFA). CEA was still exploring for uranium in its concession area north and east of the Air Mountains.

The value of mineral output in 1969, estimated at about $1.7 million, was negligible compared with other segments of the economy.[80] Foreign trade in mineral commodities in 1968, consisted mainly of the export of tin concentrate, valued at $178,000, compared with $159,000 in 1967. Imports of mineral commodities in 1968 were mainly iron and steel semimanufactures, valued at $553,000 and petroleum products, valued at $171,000. In 1967 these commodities were valued at $643,000 and $705,000, respectively.

Progress in development of the open pit mine and uranium concentration plant and ancillary facilities at Arlit was reported by Société Des Mines De l'Air (SOMAIR). However, work reportedly has been progressing more slowly than anticipated, owing to difficulty in procuring and transporting plant equipment to the mine site. Some difficulty also has been experienced in removing sandstone overburden from the mine. As a result of these problems, original production schedules have been altered to 750 tons per year by 1971 and 1,500 tons per year by 1974. SOMAIR planned to construct a 180-ton-per-day sulfuric acid plant at Arlit, which will use sulfur as the raw material supply.[81] Present plans for transporting the uranium to France and other markets reportedly envision construction of a road from Arlit to Tahoua, passing through Agadès. The concentrated uranium will be carried by truck to Carakou, Dahomey, and by railroad from Carakou to the port of Cotonou, Dahomey.

[76] Annales Des Mines (Paris). Panorama De L'Industrie Miniere. September 1969, p. 70.
[77] International Financial News Survey. Desalinization Plant Inaugurated in Mauritania. V. 21, No. 9, Mar. 7, 1968, p. 68.
[78] Petrole Information. Mauritanie. No. 1130, May 16, 1969, p. 32.
[79] Prepared by Henry E. Stipp.
[80] Where necessary, values have been converted from Communaté Financiere Africiane Francs (CFAF) to U.S. dollars at the rate of CFAF276=US$1.00.
[81] Sulfur, Niger. No. 81, March–April 1969, p. 8.

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Table 34.—Niger: Production of mineral commodities

Commodity		1967	1968	1969
METALS				
Gold, mine output, metal content	troy ounces	51	r 170	161
Tin:				
Concentrate, gross weight	long tons	79	100	122
Concentrate, metal content	do.	55	70	78
NONMETALS				
Building stone	cubic meters	748	NA	NA
Cement	thousand tons	22	23	25
Clays, common	do.	2,940	NA	NA
Gravel	cubic meters	4,211	NA	NA
Gypsum	metric tons	1,588	1,957	1,500
Limestone	do.	31,287	29,665	30,000
Salt e	do.	4,500	4,000	4,000
Sand	do.	6,320	e 3,000	2,000

e Estimate. r Revised. NA Not available.

Table 35.—Niger: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967 [1]	1968 [2]
EXPORTS			
METALS			
Tin, ore and concentrate	long tons	r 79	89
IMPORTS			
METALS			
Aluminum, metal		[3] 40	NA
Copper, metal		[3] 11	NA
Iron and steel, semimanufactures		5,066	3,846
Zinc, metal		400	NA
NONMETALS			
Cement, lime, etc.		178	508
Clays and clay products, including refactory brick		[3] 40	228
Fertilizer materials, manufactured		[3] 181	495
Pigments		262	185
Nonmetallic minerals, crude unspecified		[3] 9,079	NA
Nonmetallic mineral manufactures		NA	15
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural and manufactured		[3] 80	NA
Petroleum refinery products		[3] 5,860	866

r Revised. NA Not available.
[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1967, pp. 860–864.
[2] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1968, pp. 533–537.
[3] Statistical Office of the European Communities. Foreign Trade. No. 1, 1968, pp. 122–133 (3 months 1967).

An Italian firm, Somiren, signed a contract with SOMAIR for an 8-percent interest in the uranium operations at Arlit.

A group of Japanese firms were studying uranium deposits in Niger as a result of a French proposal for joint development of these resources. Reportedly, the Japanese group was interested in exploiting deposits at Akokan.

Petroleum exploration concessions were approved by the Niger Council of Ministers for three United States firms, Texaco, Inc., Continental Oil Co. Inc. (CONOCO), and Global Energy Co.[82] CONOCO received 111,920 square miles in the southern half of Niger adjacent to the Chad border. Texaco received 94,570 square miles in eastern Niger near Continental's area and the Chad border. Global Energy Co. was given an area in the western corner near Niamey. Terms for the concessions included a 50-percent profit-sharing with the Niger Government and expenditure during the initial 5-year period of $5.9 million by CONOCO, and $3 million by Texaco.

RWANDA [83]

No major mineral developments were reported in Rwanda in 1969. The country's mineral potential is to be evaluated by a geological survey scheduled to start in 1970 under the Special Fund of the United Nations. In addition to the minerals presently mined, other minerals known to exist include bismuth, monazite, magnetite, phosphate, and uranium.

[82] Petroleum Intelligence Weekly. Niger. V. 8, No. 51, Dec. 22, 1969, p. 6.
[83] Prepared by Eugene R. Slatick.

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Minerals are Rwanda's second most important source of foreign exchange after agricultural products; they account for about one-third of the country's total export earnings. In 1968 mineral exports were valued at about $5.6 million,[84] compared with a total of about $16 million for all exports.

Cassiterite continued to be the chief mineral produced and exported; the industry continued to be plagued by smuggling. Cassiterite production in 1969 was valued at an estimated $3.8 million, from $3.3 million in 1968. A rise in the world market prices for tin late in 1969 resulted in the liquidation of tin stocks.

La Société Minétain-Rwanda (MINETAIN), the major tin mining company, reported that its reserves were nearing depletion. Increased production will require new investment, which reportedly is unlikely in view of the uncertainties of the company's mining rights under the mining code enacted in 1967.

Wolframite production was valued at an estimated $1 million in 1969, compared with $1.2 million in 1968.

Table 36.—Rwanda: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 [1]
METALS			
Beryl, ore and concentrate, gross weight	109	148	250
Columbium and tantalum, ore and concentrate, gross weight	81	28	29
Gold, mine output, metal content—troy ounces	3	NA	NA
Tin:			
Ore and concentrate [2]—long tons	1,929	r 1,767	e 1,600
Content of concentrate—do	e 1,393	e r 1,272	1,150
Tungsten, ore and concentrate	538	r 536	440

e Estimate. r Revised. NA Not available.
[1] Estimates based on data for 9 months.
[2] Includes small quantity of mixed cassiterite-columbite-tantalite concentrate.

Table 37.—Rwanda: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967 [1]	1968 [2]
EXPORTS		
METALS		
Beryllium, beryl ore and concentrate	170	NA
Columbium and tantalum, ore and concentrate	58	NA
Tin, ore and concentrate—long tons	r 2,146	1,149
Tungsten, ore and concentrate	647	260
IMPORTS		
METALS		
Aluminum, metal, including alloys, all forms	42	NA
Iron and steel, metal, semimanufactures	1,248	2,675
NONMETALS		
Cement	18,426	NA
Salt	6,271	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	18,435	122

r Revised. NA Not available.
[1] Bulletin de Statistique, République Rwandaise. No. 13, April 1967; No. 16, January 1968; and Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1967, pp. 460–462.
[2] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1968, pp. 681–685.

SENEGAL [85]

The mineral industry of the Republic of Senegal consisted mainly of phosphate rock mining and the manufacture of cement, fertilizer materials, and petroleum refinery products. Small quantities of salt and construction materials also were produced for local use. Exploration for crude petroleum offshore on Senegal's Continental Shelf was the most notable activity in the minerals sector in 1969. The Government of Senegal, together with international organizations such as the Bureau de Récherches Géologique et Miniéres (BRGM), the European Economic Community (EEC), various organizations of the United Nations, and the U. S. Agency for International Development (AID) continued exploring for

[84] Where necessary values have been converted from Rwanda Francs (RF) to U.S. dollars at the rate of RI=US$0.01.
[85] Prepared by Henry E. Stipp.

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potable water aquifers and viable mineral deposits. To attract foreign investment capital, the Government has instituted a liberal investment code and signed an Investment Guaranty Agreement with the United States Government.

According to statistics, the value of 1969 minerals production decreased about 10 percent to $18.5 million, compared with about $20.6 million in 1968.

Senegal's foreign trade in mineral commodities consisted mainly of crude fertilizer material exports, valued at $17.8 million, and manufactured fertilizer materials, valued at $1.1 million. In 1967, exports of these materials were valued at $13.9 million and $860,000, respectively. Imports of mineral commodities in 1968 were chiefly petroleum products, valued at $4 million, and iron and steel semimanufactured products, valued at $5.9 million. In 1967, imports of these products were valued at $6.4 million and $5.5 million, respectively.

Table 38.—Senegal: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
NONMETALS				
Attapulgite		r 1,432	4,480	5,940
Cement, hydraulic	thousand tons	r 172	r 188	207
Fertilizer materials:				
Crude:				
Aluminum phosphate		151,282	r 160,400	164,398
Calcium phosphate	thousand tons	1,115	r 1,110	1,100
Manufactured:				
Aluminum phosphate, dehydrated		51,762	r 48,640	86,666
Other [1]		r 9,859	r 7,898	3,822
Salt, all types [2]	thousand tons	60	84	9
Stone, marble	cubic meters	NA	NA	183
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline, motor	thousand 42-gallon barrels	1,226	785	597
Kerosine and jet fuel	do.	133	607	415
Distillate fuel oil	do.	822	945	925
Residual fuel oil	do.	1,359	1,506	1,522
Liquefied petroleum gas	do.	57	70	75
Total	do.	3,597	3,919	3,584

r Revised. NA Not available.
[1] Includes products marketed under trade names of Baylifos and Phosphal.
[2] Includes production of Mauritania, estimated at 500 to 800 tons per year.

Table 39.—Senegal: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968 [1]
METALS		
Copper, metal, including alloys:		
Scrap	405	516
Unwrought	107	NA
Iron and steel, metal, scrap	3,607	8,087
Lead, metal, including alloys, all forms	NA	191
Other, metal	742	74
NONMETALS		
Clays and clay products, fuller's earth	e 1,600	672
Fertilizer materials:		
Crude:		
Aluminum phosphate	93,120	99,470
Calcium phosphate	r 809,500	[2] 970,675
Manufactured, phosphatic [3]	45,000	40,774
Salt and brines	18,413	NA
Other nonmetals, n.e.s.	20	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	322	5,162

e Estimate. r Revised. NA Not available.
[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1968, pp. 509–511.
[2] Principal destinations, 1968: France 246,905; Japan 198,375; Netherlands 158,287.
[3] Includes dehydrated aluminum phosphate and products marketed under trade names of Baylifos and Phosphal.

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Table 40.—Senegal: Imports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968 [1]
METALS		
Aluminum, metal, including alloys, unwrought and semimanufactures	164	142
Copper, metal, including alloys, unwrought and semimanufactures	220	93
Iron and steel, metal, semimanufactures:		
Bars, rods, shapes	11,489	15,713
Plate and sheet	8,096	6,159
Tubes, pipes, and fittings	4,540	7,892
Lead, metal, including alloys, all forms	68	69
NONMETALS		
Asbestos, crude	183	341
Cement and lime	2,277	3,288
Clays and clay products	2,268	1,617
Fertilizer materials, crude and manufactured	46,888	34,322
Sulfur	1,286	8,950
Other nonmetals, n.e.s.	NA	1,225
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude and partly refined	(2)	591,680
Gasoline	1,968	1,581
Kerosine	8,089	-------
Distillate fuel oil	88,773	42,908
Residual fuel oil	342,866	119,997
Lubricants	8,224	7,050

NA Not available.
[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1968, pp. 512–525.
[2] Less than ½ unit.

The major decrease in minerals production occurred in the output of aluminum and calcium phosphate. Compagnie Sénégalaise des Phosphates de Taiba was reorganizing its operations by changing to a new system for hauling ore and using bucket wheel excavators for mining ore and stripping overburden. Reserves were estimated at 40 million tons of recoverable ore. A plant with a capacity for manufacturing 100,000 tons per year of various fertilizer materials from local phosphate rock was described.[86] The plant, located about 9 miles east of Dakar, was owned by Société Industrielle D'Engrais Au Sénégal.

Decree 67-1006, September 10, 1967, which establishes an ad valorem tax on all products mined in Senegal except crude petroleum and natural gas, is the most recent legislation on mining or petroleum enacted.

Casamance Sulfur Co. and Casamance Petroleum Co., subsidiaries of Texas Gulf Sulfur Co. (TGS), conducted a marine gravity survey on the marine exploration area held jointly by TGS and Compagnie des Petroles Total Afrique de l'Ouest (COPETAO).[87] A seismic survey was conducted for the two companies by Western Geophysical Co. Two wells were started at yearend. One of these was a wildcat oil well located in the northwestern part of the exploration area.

Esso Exploration Senegal was drilling a well in its exploration area, which extends offshore from Dakar southward to the border with Gambia.

SOMALI REPUBLIC[88]

Data are not available for mineral production in 1969; however, the principal mineral output probably consisted of a few hundred tons of salt. Exploration for uranium and petroleum continued.

During the year Uran Erzbergbau, a West German company, was granted a uranium exploration concession northwest of Mogadiscio. The company is the third to undertake uranium exploration; the others are Western Nuclear Inc. and Nucleare Somala, a subsidiary of Italy's Ente Nazionale Idrocarburi (ENI). Late in the year Nucleare Somala and Uran Erzbergbau awarded contracts to Hunting Geology and Geophysics for airborne spectometer, magnetometer, and photographic surveys over their concession areas.

A group on nine Japanese electric power

[86] Dedryver, E. Construction d'une Usine d'Engrais Au Sénégal Mines et Chimie, No. 140, 1969, pp. 115–121.
[87] World Petroleum Report. Senegal. V. 16, 1970, p. 98.
[88] Prepared by Eugene R. Slatick.

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companies announced plans to send a team to Somalia to study the exploratory work being done for uranium.

Sinclair Oil Co. and Marathon Petroleum Corp. relinquished their interests of 25 percent each in the United States-West German consortium that has concession areas totaling about 100,000 square kilometers along the coast. The German members of the consortium formed a new group and will continue exploratory work. No oil discoveries were reported during the year.

There were no further developments regarding the reopening of the marine salt works at Ras Hafun. Several studies have been made, but no definite plans have been reported.

The activity of the United Nations Development Program continued under the second phase, which consists mainly of more intensive studies of earlier mineral discoveries, particularly uranium, thorium, and rare-earth minerals.

SPANISH SAHARA [89]

During the year Empresa Nacional Minera del Sahara (ENMINSA), the Spanish State-owned mining company responsible for mining the phosphate deposits at Bou-Craa, established the operating subsidiary of Fosfatos de Bou-Craa, S.A. ENMINSA was still negotiating with a French consortium regarding their possible participation in the project.

Production at the rate of 3.3 million tons of concentrates is expected to begin in mid-1971, when a 5-million-ton-per-year beneficiation plant is scheduled to be operating. Two other similarly sized plants are reported to be planned so that the total annual output of concentrates will eventually reach 10 million tons. The first plant is to be built by Klöckner-Humboldt-Deutz of West Germany at a cost of about $7 million.

At yearend 1969, construction was almost finished on the port installations at El Aiún, where vessels of up to 100,000 deadweight tons will be accommodated, and the 60-mile, 2,000-ton-per-hour conveyor system that will link the deposit with the port.

The Government of Morocco renewed its claim to the phosphate deposits in the Spanish Sahara. The reserves are estimated at 3 billion tons; the thickness of the deposits range from 9 to 30 feet.

During the year Continental Oil Co. (CONOCO) began drilling a well, called Spansah 51a–1, about 90 miles north of Villa Cisneros, in about 260 feet of water. CONOCO is part of a group comprised of Compania Española de Petróleos, S.A. (CEPSA), and Spanish Gulf Oil Company. The CEPSA-Gulf combine drilled an unsuccessful well north of the present site in 1966.

In April Union Carbide Corp. applied for offshore permits totaling 3.9 million acres.

SUDAN [90]

There was little development in Sudan's mineral industry, a minor part of the country's economy. In October the Council of Ministers of the new Government, established by coup d'etat in May, passed a resolution to nationalize the import of products that are vital to the country. It also decided to create a national petroleum corporation that would control petroleum refining, marketing, and trade. It called for a majority share in the Port Sudan petroleum refinery, which is owned by Shell and CP (Sudan) Ltd. Studies by a Soviet exploration team in October indicated that oil could be present in parts of eastern Sudan. Further studies are scheduled.

A 170,000-ton-per-year fertilizer complex is planned for Sennar. It will cost about $30 million. Earlier plans were to build a smaller plant at El Roseires.

A new cement factory began production during the last half of the year at Rabak, across the White Nile from Kosti.[91]

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[89] Prepared by Eugene R. Slatick.
[90] Prepared by Eugene R. Slatick.
[91] Barclays Overseas Review (London). November 1969, p. 31.

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Table 41.—Sudan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Chromite, gross weight—thousand tons	25	22	26
Gold, mine output, metal content—troy ounces	200	29	NA
Iron and steel, iron ore and concentrates—thousand tons	14	------	------
Manganese, ore and concentrate, gross weight	2,500	5,000	850
NONMETALS			
Cement, hydraulic—thousand tons	133	145	175
Gypsum and anhydrite, crude	3,732	10,226	NA
Magnesite, crude	4,000	6,500	500
Salt, all types	57	50	51
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products—thousand 42-gallon barrels	•4,300	4,063	4,978

• Estimate. NA Not available.

Table 42.—Sudan: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
EXPORTS		
METALS		
Chromium, ore and concentrate	NA	10,894
Iron and steel:		
Ores	8,750	10,015
Metal, scrap	7,857	1,590
Other nonferrous base metals, ore and concentrates	[1] 20,500	NA
IMPORTS		
METALS		
Aluminum, metal, including alloys, all forms	1,390	953
Copper, metal, including alloys, all forms	155	156
Iron and steel, metal, semimanufactures	77,284	108,362
Lead, metal, including alloys, all forms	69	244
Zinc, metal, including alloys, all forms	9	265
Metallic oxides, mainly for paints	222	152
NONMETALS		
Abrasives, all forms	81	92
Cement—thousand tons	17	8
Chalk	144	250
Clays and clay products (including refractory bricks)	423	675
Fertilizer materials:		
Manufactured:		
Nitrogenous	66,065	9,073
Phosphatic	330	145
Mixed (other)	10	2,079
Sulfuric acid and other inorganic acids	480	247
Gypsum	4	884
Lime	410	6
Salt	47	93
Sodium and potassium compounds, n.e.s	3,171	3,012
MINERAL FUELS AND RELATED MATERIALS		
Coke and semicoke	-------	1,000
Petroleum:		
Crude—thousand 42-gallon barrels	•5,900	4,902
Refinery products—do	1,626	3,086

• Estimate. NA Not available.

[1] Includes manganese ore and concentrates.

SWAZILAND [92]

The mineral industry of Swaziland continued to expand output of its principal commodities—iron ore, asbestos, and coal. Development of a mineral industry has resulted in a substantial increase in revenue received by the Government. In the 1969–70 fiscal year, estimated revenue from land and minerals was $336,000,[93] or about 1.6 percent of total revenue received by the Government. The economy of the country also was aided by remittances of $151,558, mainly from 7,500 Swazis working in the gold mines of the Republic of South Africa. The Swaziland Government announced a $32.3 million Development

[92] Prepared by Henry E. Stipp.

[93] Where necessary, values have been converted from South African rands (R) to U.S. dollars at the rate of R1=US$1.40.

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Plan, which would invest about $3.5 million in mining, industry, and commerce over a 5-year period, starting in the 1969–70 fiscal year. Investment would be in infrastructure, improved education, training, and other services needed by the private sector for minerals development. The Government also pledged to encourage investment of foreign capital in the mining industry and other sectors of the economy. Swaziland's Government concluded an agreement with the Republic of South Africa for a revision of the Customs Union agreement of 1910.

The British Government agreed in principle to finance the first phase of a survey of coal reserves in the Bushveld area of Swaziland. Problems involved in building a thermal power station and use of the coal for power generation also would be studied.[94] The Geological Survey and Mines Department was drilling iron ore deposits for evaluation and beneficiation tests on the ore. This investigation was conducted under a United Nations Development Program grant. In September it was announced that Swaziland had joined the International Monetary Fund and the World Bank.

Production of mineral commodities in Swaziland was valued at $27.4 million in 1969, compared with about $25.6 million in 1968. The rise in total value of minerals production was mainly the result of an increase of 8.5 percent in the value of iron ore to about $17.9 million, and an increase of 5 percent in the value of asbestos to $8.8 million.

Foreign trade in mineral commodities in 1968 consisted chiefly of exports of iron ore valued at $16.6 million, asbestos valued at $8.5 million, and coal valued at $132,580. In 1967 exports of these commodities were valued at $15.8 million, $8.2 million, and $90,020, respectively. Exports of iron ore were shipped mainly to Japan. Asbestos exports went mainly to the United Kingdom, Belgium, and France. Quantity figures for mineral exports were not available except for iron ore, which totaled 2,050,420 metric tons in 1968, compared with 1,743,519 tons in 1967. Statistics on imports of mineral commodities in 1968 were not available except for mineral fuels and lubricants which were valued at $4.1 million, compared with $4.8 million in 1967.

Representatives of several Japanese steel firms were interested in increasing and extending shipments of iron ore from the Ngwenya mine operated by Swaziland Iron Ore Development Co.[95] Iron ore now being shipped to Japan contains about 64.5 percent iron. Additional exports of iron ore to Japan would be lower in grade; however, these sales could be profitable to the mining company and Government since investment in plant and equipment would have been largely depreciated by 1974 when the present contract ends. Japanese firms also were investigating the feasibility of prospecting and mining unleased iron ore resources.[96]

Prospecting work on asbestos deposits near Emlembe, being conducted by a sub-

[94] S.A. Mining and Engineering Journal (Johannesburg). Swaziland Study of Coal Resources. V. 80, Pt. 2, No. 3997, Sept. 12, 1969, p. 615.
[95] Standard Bank Review (London). Swaziland. November 1969, p. 30.
[96] Standard Bank Review (Johannesburg). Swaziland. No. 611, February 1970, p. 27.

Table 43.—Swaziland: Production of mineral commodities
(Metric tons unless otherwise specified)

Commodity[1]	1967	1968	1969
METALS			
Iron ore, direct shipping—thousand tons	1,744	2,050	2,308
NONMETALS			
Asbestos, chrysotile	36,427	r 36,197	39,087
Barite	565	888	571
Clays, kaolin	1,860	2,145	1,657
Stone:			
Pyrophyllite	599	581	599
Other	28,171	[2] 48,577	[2] 52,588
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous	77,962	96,789	104,253

r Revised.
[1] In addition to commodities listed, simple construction materials such as clays and sand and gravel were produced, but quantitative data are not available.
[2] Cubic yards.

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sidiary of London-Rhodesia Mining and Land Co. Ltd., was expected to be concluded in 2 to 3 years.[97]

Swaziland Collieries Ltd. completed a vertical prospect shaft 7 miles south of its mine at Mpaka.[98] Bulk samples of coal were obtained from the shaft and given to potential buyers. A Japanese firm, Sumitomo Shoji, expected to purchase good quality coking coal from Swaziland.[99]

Deposits of kaolin and pyrophyllite reportedly were being mined in the Usutu area located between the Mkhondvo and Great Usutu rivers.[1] Applications to mine other known deposits of pyrophyllite and silica have been received. Low-grade iron ore deposits also occur in the vicinity of Gege, but are not considered to be of economic importance.

Anglo American Corporation of South Africa, Ltd. of South Africa was surveying, by soil and stream analyses, 5,800 square miles of Swaziland.[2] The investigation was expected to last for about 1 year. Anglo American's contract with Swaziland did not guarantee to give the corporation exclusive prospecting rights to any area of mineral occurrence found.

TOGO [3]

In 1969 phosphate rock mining and processing continued as Togo's principal mineral industry as well as a major one in the country's economy. A marble industry began late in the year, and steps were undertaken to establish cement and salt industries.

Compagnie Togolaise des Mines du Bénin continued to be the only producer of phosphate rock. Output in 1969 totaled 1,472,682 tons, compared with 1,375,000 tons in 1968. The value was $16.6 million [4] in 1969, compared with $15.6 million in 1968. Exports of phosphate rock in 1968 totaled 1,357,000 tons; the two chief destinations were France (568,600 tons) and the Netherlands (335,700 tons). During 1969 four separators with high-intensity electro-magnetic fields were installed in the preparation plant. They will enrich the output by reducing the content of ferric and aluminum oxide from 4.5 percent to less than 2 percent.[5]

A marble quarry at Gnaoulou and a processing complex at Lomé began operations late in the year. Production in 1969 totaled 2,500 tons, but it is expected to reach about 20,000 tons in 1970, mostly for export. The operating company is Societe Togolaise de Marbrerie et de Materiaux (SOTOMA), a joint venture comprised of the Togolese Government and Italian private interests. SOTOMA plans to use domestic kaolin deposits to operate a ceramic plant at the complex, and local clays to make bricks at a rate of about 25,000 per day.

Plans were underway to start building a 100,000-ton-per-year clinker-crushing cement plant near Lomé. Initially, the plant will use imported clinker to produce ce-

[97] Standard Bank Review (London). Swaziland. February 1970, p. 26.
[98] Work cited in footnote 96.
[99] Japan Echo. No. 1810, Aug. 15, 1969, p. 3.
[1] Mining Journal (London). Swaziland's Minerals. V. 272, No. 6972, Apr. 4, 1969, p. 282.
[2] Mining Journal (London). Swazi Mineral Survey. V. 274, No. 7013, p. 58.
[3] Prepared by Eugene R. Slatick.
[4] Where necessary, values have been converted from Communauté Financiere Africiane Francs (CFAF) to U.S. dollars at the rate of CFAF247=US$1.00; the rate was changed in August to CFAF278=US$1.00.
[5] Mining Journal (London). V. 273, No. 7009, Dec. 19, 1969, p. 559.

Table 44.—Togo: Foreign trade in selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1967	1968
EXPORTS		
NONMETALS		
Fertilizer materials, crude phosphate	1,005,199	1,362,107
IMPORTS		
METALS		
Iron and steel, metal, semimanufactures, all forms	9,348	4,162
NONMETALS		
Cement, lime, and other building materials	29,792	20,272

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ment for the local market. If the large limestone deposits at Avéta are developed, clinker-making facilities will be built with a capacity of about 1 million tons per year. The output would be for the local and export markets. The economic feasibility of developing the deposits has been questioned because the limestone contains a high percentage of phosphate.

Societe des Salines du Togo (SALINTO) plans to extract salt from sea water at an initial rate of 6,750 tons per year. No date was set for the project.

Togo's first exploration oil well was being drilled offshore late in the year by Frontier Togo Petroleum Co. The well was about 12 miles southeast of Lomé and in 187 feet of water; the total drilling depth was scheduled for about 8,000 feet. In December Ashland Oil and Refining Co. acquired the 9-percent interest that Industrial Resources and Capitalization, Inc., held in Frontier Togo Petroleum Co. The ownership of Frontier Togo Petroleum Co. is as follows: Union Carbide Petroleum Corp., 37 percent; Amerada Hess Corp., 37 percent; Frontier Petroleum Co., 8 percent; Kock Industries, 9 percent; and Ashland Oil, 9 percent.

A mineral survey carried out with the assistance of the United Nations Development Program reported copper-bearing sulphide deposits in the Palimé area. The deposits were being evaluated. Preliminary studies indicate that they may be exploited for copper and pyrite.

UPPER VOLTA [6]

No recorded minerals were mined in Upper Volta in 1969; the most recent mining, for gold, was in 1966. Large reserves of manganese are present in the northeast, at Tambao, but they are not being developed. Several companies, including a U.S. firm, are interested in exploiting the manganese, but no one has been willing to finance the projects that will make the exploitation feasible.[7] Chief among these is a 219-mile railroad from Ouagadougou to the deposits. The Government hopes to build the railroad with the assistance of the United Nations Development Program.

Other potentially exploitable mineral deposits include copper at Diénéméra and limestone at Tin Hrassan. Prospecting for antimony, lead, and molybdenum is expected to begin in 1970.

[6] Prepared by Eugene R. Slatick.
[7] International Commerce. V. 76, No. 15, Apr. 13, 1970, p. 25.

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The Mineral Industry of Other Near East Areas

By David A. Carleton,[1] E. Shekarchi,[2] Eugene R. Slatick,[3] and Walter C. Woodmansee [4]

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BAHRAIN [5]

Major mineral developments in Bahrain in 1969 involved the petroleum industry and the Persian Gulf's first aluminum smelter. Construction of the new aluminum plant by Aluminium Bahrain, Ltd. (Alba), began in January 1969. During the year, ownership of Alba changed by the addition of new members. Currently Alba is a consortium consisting of the Government of Bahrain, 20 percent, and the following foreign companies: General Cable Corp. (a United States firm), 18 percent; British Metal Corp., 18 percent; Aktiebolaget Electrokopper (a Swedish company), 18 percent; Western Metals Corp. (a British firm), 10 percent; and Guinness Mahon (an international banking and investment firm), 7 percent. The remaining ownership is unknown. When completed in 1972, at a cost of $72 million, the 90,000-ton-per-year plant will employ about 600 persons and will be expected to provide about an equivalent of $50 million annually in export earnings. The plant will use alumina from Western Australia and natural gas from Bahrain's oilfield.

Crude oil production from Bahrain's only oilfield averaged 76,093 barrels daily in 1969 just slightly above that for 1968. Natural gas produced during the year totaled 33,440 million cubic feet. Of this, 10,906 million cubic feet were used as fuel at the Jufair powerplant and the Bahrain Petroleum Co. Ltd. (BAPCO) refinery while the remainder was injected into the oilfield for reservoir pressure maintenance and conservation purposes.

Two natural gas development wells were drilled into the pre-Permian (Khuff Zone) gas reservoir underlying Bahrain's oilfield. Gas from these wells will fuel gas turbine generators to produce electricity needed for smelting at the new aluminum plant.

Six oil development wells were drilled into the Bahrain Zone during 1969 and the extensive workover program which began in 1968 was completed during the year. Continued field improvements by BAPCO which helped bring about the

[1] Supervisory foreign mineral specialist (petroleum), Bureau of Mines, Washington, D.C.

[2] Foreign mineral specialist, Bureau of Mines, Washington, D.C.

[3] Foreign mineral specialist (petroleum), Bureau of Mines, Washington, D.C.

[4] Physical scientist, Bureau of Mines, Washington, D.C.

[5] Prepared by David A. Carleton, Bureau of Mines, Washington, D.C.

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Table 1.—Bahrain: Production of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1967	1968	1969 p
Crude petroleum	25,370	27,598	27,774
Petroleum refinery products:			
Gasoline and naphtha	16,817	12,956	15,648
Jet fuel	13,407	15,227	13,752
Kerosine	2,804	1,895	1,102
Distillate fuel oil	13,963	13,682	17,101
Residual fuel oil	37,844	35,574	35,651
Other	811	1,845	222
Total	85,146	80,679	83,476
Refinery fuel and loss	4,020	3,866	3,900

p Preliminary.

Table 2.—Bahrain: Trade of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1967	1968	1969
EXPORTS			
Petroleum refinery products:			
Gasoline and naphtha	16,577	12,538	15,395
Jet fuel	13,152	15,236	13,681
Kerosine	2,353	2,097	1,032
Distillate fuel oil	12,562	13,165	15,915
Residual fuel oil	29,559	28,971	29,750
Other	667	1,665	1,001
Total	74,870	73,672	76,774
IMPORTS			
Crude petroleum	62,445	55,881	58,230
Petroleum refinery products:			
Gasoline and naphtha	1,441	1,057	1,588
Kerosine	212	157	174
Residual fuel oil	108	16	------
Lubricants	10	10	11
Other	17	[1] 50	------
Total	1,783	1,290	1,773

[1] Distillate fuel oil.

small increase in production in 1969 included additional gas-oil separators, electrification of storage tank pumps, and water removal facilities. At yearend 1969 there were 213 oil wells, 7 gas wells, and 6 gas injection wells.

BAPCO's refinery throughput averaged 239,385 barrels daily in 1969, an increase of 4 percent compared with that of 1968. To achieve this two new storage tanks were built during the year and the capacity of the visbreaker was increased from 20,000 to 30,000 barrels per day. The latter expansion permits increased feed of the heaviest stocks for which there is little demand, while allowing for increased production of distillate fuel oil for which there is an expanding demand. Other refinery improvements include replacement and expansion of water-cooling equipment.[6]

JORDAN [7]

No significant changes occurred in Jordan's mineral sector in 1969. Phosphate, cement, and petroleum refining remained the chief mineral industries. Exports of phosphate, the principal mineral exported, were valued at $11.8 million[8] in 1968 as compared with $9.7 million in 1967.

Phosphate production declined slightly in 1969. The drop reportedly was due to shipping problems at the port of Beirut and marketing difficulties, especially with India and Turkey.

In January Jordan Phosphate Mines Co.

[6] Bahrain Petroleum Co., Ltd. Annual Report. 1969.

[7] Prepared by Eugene R. Slatick.

[8] Where necessary, values have been converted from Jordanian dinar (JD) to U.S. dollars at the rate of JD1=US$2.80.

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formerly inaugurated new storage and bulk-loading facilities at Aqaba. The additions were necessary because of increasing phosphate exports. The facilities cost $8.6 million, of which $4.6 million was borrowed from West Germany.

The major phosphate export agreements signed during 1969 were with Turkey (120,000 tons annually from 1969 to 1972 and 600,000 tons annually from 1972 to 1977), and Rumania (30,000 tons in 1970 and 500,000 tons from 1971 to 1975).

Under an agreement signed late in the year, the economic potential of phosphate and potash deposits in the Lissan Valley is to be evaluated for the Government by a West German firm.

In January a fourth kiln began operations at the Jordan Cement Co. It increased the plant's capacity to about 1,800 tons per day and will help satisfy the rising demand for cement by the construction industry.

In September, Industrija Nafte Zagreb (INA) drilled its first exploration well about 80 kilometers east of Ammann. Oil indications were found, but there were no reports about the commercial possibilities. If commercial production is established, INA will join with the Government's Natural Resources Authority to form a new company, Jordan Yugoslav Petroleum Company (JOYUPEC). Late in the year Deminex, a West German company, received the Government's approval in principal to acquire 30-percent interest in INA's share of the concession.

During the year the capacity of the petroleum refinery at Zerka was being expanded from 7,500 to about 15,000 barrels per day. The work is scheduled to be completed in February 1970.

In 1969 the Government received about $4 million dollars in royalties and related payments from the Trans-Arabian Pipeline Co. (TAPline).[9] This was about $1 million less than in 1968. The lower revenue was due to the closure of the line for about 3 months after a part of the line was sabotaged.

[9] Petroleum Press Service. V. 37, No. 6, June 1970, p. 221.

Table 3.—Jordan: Production of mineral commodities

Commodity[1]		1967	1968	1969
NONMETALS				
Cement	thousand metric tons	321	381	511
Fertilizer materials, phosphate rock	do	1,237	1,162	1,087
Salt	do	12	16	18
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline, motor	thousand 42-gallon barrels	614	609	738
Kerosine	do	534	510	534
Distillate fuel oil	do	879	908	921
Residual fuel oil	do	586	593	759
Liquefied petroleum gas	do	114	129	338
Asphalt	do	174	203	236
Total	do	2,901	2,952	3,521

[1] In addition to commodities listed, Jordan also produces gypsum, limestone for cement manufacture, and steel reinforcing rods from imported ingot.

Table 4.—Jordan: Exports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
NONMETALS		
Cement	9,242	64,636
Granite and other building stone	5,227	8,050
Lime	244	------
Marble	1,013	1,222
Phosphate (dry)	881,658	1,094,227

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Table 5.—Jordan: Imports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum and alloys, semimanufactures		447	524
Copper and alloys, all forms		273	189
Iron and steel semimanufactures		88,025	45,897
Lead and alloys, unwrought		430	448
Metallic oxides		178	268
NONMETALS			
Cement		36,511	5,143
Ceramic construction materials		813	861
Fertilizer materials:			
Natural, phosphate		444	538
Manufactured:			
Nitrogenous		9,109	4,229
Phosphatic		4,259	6,132
Potassic		1,843	876
Other		741	------
Lime		1,461	2,025
Marble		410	610
Refractory materials, bricks, tiles, etc		1,376	304
Sulfur		1,793	788
MINERAL FUELS AND RELATED MATERIALS			
Coal, coke, and briquets		------	469
Petroleum:			
Crude	thousand 42-gallon barrels	8,094	8,104
Refinery products	do	221	350

LEBANON [10]

There were no major new developments in production of mineral commodities in Lebanon during 1969. Production activities remained limited to finished steel products at two rolling mills, a few nonmetallic mineral commodities, and petroleum products at Lebanon's two oil refineries. In the nonmetals sector, despite a continuing lag in construction activity and lower demand, cement output increased substantially, according to the Statistical Office of the Ministry of Planning. On the basis of the manufacturers' selling price per ton delivered at railhead, Beirut, production of cement was valued at $22.8 million.[11] Refinery throughput of crude oil was valued at $30.2 million, based on posted prices at the Tripoli terminal ($2.21 per barrel) and the Sidon terminal ($2.17 per barrel). Value of petroleum refinery products was estimated at $39.7 million on the basis of yearend exrefinery prices.

Principal mineral commodity exports during 1968 (excluding transshipped crude petroleum and petroleum refinery products for which data are incomplete) were gold, $5.1 million; iron and steel, mainly semimanufactures, $4.1 million; aluminum, $2.9 million; and fertilizers, $1.5 million. Exports of mineral commodities (list in table 7) were valued at $21.9 million, about 13 percent of total exports of all commodities.

Principal mineral commodity imports in 1968 (excluding crude petroleum) were gold, $87.6 million; the mineral fuels, mainly petroleum refinery products, $31.7 million; iron and steel, mainly semimanufactures, $23.4 million; and nonferrous metals, mainly aluminum and copper, $4.7 million. Imports of mineral commodities (listed in table 8) were valued at $165.2 million, about 27 percent of total imports.

Crude oil flow through the pipeline of Trans-Arabian Pipeline Co. (TAPline) was disrupted by Arab commando attacks during the year. On May 30 the line was extensively damaged in Israeli-occupied Syria, a few kilometers from the Lebanon frontier; in October a storage tank at the Zahrani terminal, near Sidon, was damaged; and in November the line was damaged a few kilometers from the tank farm. Oil flow was not significantly affected on the two latter occasions, but the May attack resulted in shutdown of the line until September 18. Crude oil exports were suspended early in July following a Government order that Mediterranean Refining Co. (MEDRECO), which operates the Sidon refinery, maintain stocks of about 3 million barrels (400,000 tons) for refinery

[10] Prepared by Walter C. Woodmansee.

[11] Where necessary, values have been converted from Lebanese pounds (£L) to U.S. dollars at a rate of 1£=US$0.3246.

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Table 6.—Lebanon: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity		1967	1968	1969
METALS				
Iron and steel, semimanufactures •		55	55	60
NONMETALS				
Cement		1,016	906	1,253
Clays, kaolin		3	------	------
Dolomite	metric tons	140	------	------
Gypsum •		30	40	30
Lime •		50	90	120
Quartz, silica sand •		10	10	------
Salt •		30	30	28
MINERAL FUELS AND OTHER RELATED MATERIALS				
Petroleum refinery products:				
Gasoline	thousand 42-gallon barrels	2,633	r 2,949	2,957
Kerosine and jet fuel	do	1,440	r 1,473	1,649
Distillate fuel oil	do	2,010	r 2,096	2,375
Residual fuel oil	do	6,018	r 6,030	5,888
Other, including liquefied petroleum gas	do	135	r 267	445
Total	do	12,236	r 12,815	13,814

• Estimate. r Revised.

Table 7.—Lebanon: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
METALS			
Aluminum, metal, including alloys, all forms		2,570	3,888
Copper, metal, including alloys, all forms		485	572
Gold, metal, unworked or partly worked	troy ounces	108,903	230,424
Iron and steel:			
Scrap		80,514	26,169
Pig iron		131	23
Steel, primary forms and semimanufactures		14,535	28,794
Lead, metal, including alloys, all forms		172	454
Magnesium, metal, semimanufactures		4	19
Platinum group, metals, including alloys, all forms	troy ounces	450	1,102
Silver, metal, including alloys, all forms	do	62,726	488,726
Zinc, metal, including alloys, all forms		1	3
Other metals, precious, waste and scrap	troy ounces	25,380	779,526
NONMETALS			
Abrasives, natural, pumice, emery, natural corundum, etc		28	236
Cement		35,513	66,833
Chalk		44	28
Clays and clay products:			
Crude clays		42	23
Products:			
Refractory		139	123
Nonrefractory		553	687
Diamond, all grades	carats	555	6,205
Diatomite		5	6
Fertilizer materials:			
Crude		27	91
Manufactured:			
Nitrogenous		9,855	3,036
Phosphatic		17,483	88,116
Potassic		10	11
Other		1,071	42,365
Ammonia		1,681	15
Gem stones, precious and semiprecious, except diamond	carats	173,245	90,500
Graphite		9	646
Gypsum and anhydrite		693	1,092
Lime		40,016	38,415
Pigments, mineral		13	31
Pyrite		94	224
Salt		11	4
Sodium and potassium compounds, caustic soda and caustic potash		39	78
Stone, sand and gravel:			
Dimension stone, crude and partly worked:			
Calcareous		856	1,837
Noncalcareous		44	32
Dimension stone, worked		1,043	1,311
Gravel and crushed rock		736	1,337
Sand		2,047	1,182
Sulfur:			
Elemental, all forms		793	855
Sulfuric acid		1,681	1,328
Talc and steatite		3	80
Nonmetals, n.e.s., building materials of asphalt, asbestos, and fiber cement		27,433	34,692
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		32	58
Coal, all grades		950	959
Coke and semicoke		994	1,843
Petroleum refinery products, mainly residual fuel oil	thousand 42-gallon barrels	• r 1,800	1,851

• Estimated. r Revised.

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Table 8.—Lebanon: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Oxide and hydroxide	751	972
Metals, including alloys, all forms	4,236	5,049
Copper, metal, including alloys, all forms	630	630
Gold, metal, unworked or partly worked, thousand troy ounces	2,940	2,297
Iron and steel, metal:		
Scrap	2,167	4,902
Pig iron and ferroalloys	5,223	11,892
Steel, semimanufactures	222,805	239,170
Lead:		
Oxide	102	66
Metal, including alloys, all forms	1,326	1,432
Mercury, 76-pound flasks	60	182
Nickel, metal, including alloys, all forms	5	10
Platinum group, metals, including alloys, all forms, troy ounces	4,092	4,261
Silver, metal, including alloys, all forms, do	56,072	19,774
Tin, metal, including alloys all forms, long tons	38	38
Titanium, oxide	679	888
Zinc:		
Oxide	42	71
Metal, including alloys, all forms	504	866
NONMETALS		
Abrasives, natural, pumice, emery, natural corundum, etc	47	72
Asbestos	5,024	6,647
Barite	32	50
Cement	7,418	22,583
Chalk	1,122	1,684
Clays and clay products:		
Crude clays	3,328	5,254
Products:		
Refractory	4,466	2,619
Nonrefractory	8,006	7,239
Diamond, all grades, carats	67,710	73,240
Diatomite	139	295
Feldspar and fluorspar	385	774
Fertilizer materials:		
Natural:		
Phosphate rock	4,012	123,538
Other	839	6,300
Manufactured:		
Nitrogenous	21,654	28,083
Phosphatic	304	3,194
Potassic	7,581	8,018
Other	656	13,499
Ammonia	1,994	28,494
Gem stones, precious and semiprecious, except diamond:		
Natural, thousand carats	2,346	6,002
Manufactured, do	3,712	3,005
Powder, waste, etc	------	2,070
Graphite	35	93
Gypsum and anhydrite	20,548	37,776
Lime	10	20
Magnesite	9	5
Mica, all forms	6	9
Pigments, mineral, including processed iron oxides	118	224
Pyrite	58	6
Salt	594	228
Sodium and potassium compounds, caustic soda, caustic potash	3,085	3,811
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked:		
Calcareous	19,083	20,088
Noncalcareous	3,720	3,563
Worked	406	150
Dolomite	10	6
Gravel and crushed stone	8,796	9,700
Quartz and quartzite	18	26
Sand	4,317	1,457
Sulfur:		
Elemental, all forms	13,079	41,431
Sulfuric acid	43	22,521
Talc and steatite	292	405

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Table 8.—Lebanon: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1967	1968
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		25	14
Carbon and carbon black		87	56
Coal, all grades		2,202	1,855
Coke and semicoke		2,280	5,848
Peat		55	16
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	2,539	2,886
Kerosine	do	375	363
Gas oil and fuel oil	do	3,879	4,281
Lubricants	do	96	111
Liquefied petroleum gas	do	577	580
Bituminous residues and mixtures	do	153	62
Other	do	6	73
Total	do	7,625	8,356
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		468	498

Table 9.—Lebanon: Crude oil pipeline statistics

(Thousand 42-gallon barrels)

	1968	1969
Trans-Arabian Pipeline Co. (TAPline)		
Throughput	172,367	121,336
Average per day	471	332
Export	167,364	118,757
Average per day	457	312
Iraq Petroleum Co. (IPC) [1]		
Throughput	169,042	167,537
Average per day	462	459
Export	161,016	158,996
Average per day	440	436

[1] Data provided by IPC in long tons; factor of 7.5 barrels per long ton used for conversion to barrels.

throughput. Following closure of the line, negotiations were underway involving the United States, Israel, and the Arab States. Repairs started in July. Additional safety valves were installed.

As a result of the pipeline damage, TAPline throughput and exports during 1969 were reduced by 30 percent and 32 percent, respectively, compared with 1968. Operations of the Iraq Petroleum Co. (IPC) pipeline remained normal throughout the year. When TAPline oil flow was resumed, throughput reached record levels. The average rate during December was 501,210 barrels per day. Crude oil exports expanded less rapidly; tankers had to be rescheduled.

Crude oil throughput at Lebanon's two refineries averaged 36,601 barrels per day (20,766 barrels per day at IPC and 15,835 barrels per day at MEDRECO), compared with a total of 35,301 barrels per day in 1968. A third refinery, with Saudi Arabian participation through General Petroleum and Mineral Organization (Petromin), the national oil company, remained under consideration. Negotiations continued between Lebanon and Saudi Arabia, but agreement was not reached. Because of this consideration for a third refinery, the Government ordered IPC to stop its refinery expansion project.[12]

MUSCAT AND OMAN [13]

The production of crude oil, the only major mineral produced in Muscat and Oman, averaged 327,972 barrels per day in 1969, up 34 percent from 1968. Petroleum Development Oman, Ltd. (PDO), currently the country's only concessionaire, reduced its concession area in the Muscat

[12] Oil and Gas Journal. V. 67, No. 29, July 21, 1969, p. 50.

[13] Prepared by David A. Carleton.

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and Oman province of the nation (excludes Dhofar province) from about 84,000 to about 60,000 square miles. Areas relinquished include substantial portions along the southeast coast, Masira Island, and Musandam Peninsula on the Strait of Hormuz. Also during the year, PDO obtained a lease covering the Dhofar area which covers some 39,654 square miles.

Petroleum exploration by PDO during 1969 included 74 party-months of geophysical surveys, one oilfield discovery, and four dry wells. The discovery well, Al Huwaisa, which is about 15 miles southwest of Yibal oilfield, yielded a low sulfur crude oil that flowed at 5,600 barrels per day. Plans are to connect the new field to production and pipeline facilities at Yibal in 1970. Yibal field came on stream early in 1969 and by yearend production was averaging about 25,000 barrels per day.

All of the country's production is exported from the Mina al Fahal loading terminal. Japan was the destination of 28 percent of 1969 crude oil exports; most of the remainder went to West European countries.

The offshore concession is held by a consortium of five West European companies (80 percent) and Union Carbide Corp. (20 percent). The only well known to be drilled began operating in August 1968 and was abandoned the following December at a depth of 13,205 feet.

QATAR [14]

The only major mineral producing facilities in Qatar, other than petroleum, are a cement plant completed in 1969 and a fertilizer plant under construction. Petroleum production, which sustains the country's economy, was valued in 1969 at $220 million based on realized prices and provided about $117 million in Government income. Included in the latter are some retroactive payments and concession bonuses. An addition to Qatar's income is expected to come from a new field which straddles the recently defined offshore boundary with Abu Dhabi. The field, Bunduq, will be developed by an Abu Dhabi concessionaire. Revenues from this field's production, initially envisaged at 30,000 to 40,000 barrels per day, are to be divided equally between Qatar and Abu Dhabi.

Crude oil production, which averaged 355,740 barrels daily in 1969, rose only 4.3 percent during the year, the lowest rate of increase since 1963. Production from the only onshore field (Dukhan), the only field of Qatar Petroleum Co. (QPC), rose 3.7 percent to 200,847 barrels per day. The small increase after several years of decline resulted from a successful water injection program and a concomitant workover well program. QPC plans to raise daily production to 214,000 barrels in 1970. The sulfur content of QPC crude oil is 1.04 percent, low by Persian Gulf standards.

Output from the two offshore fields of Shell Oil Co. of Qatar, Ltd., averaged 154,893 barrels per day, about three-fourths of which came from the Maydam Mahzam field. This field is scheduled to have a water injection system installed to raise daily production to about 170,000 barrels. Under a long-term contract, 20 percent of Shell's production goes to Ente Nazionale Idrocarburi (ENI), the Italian State petroleum agency.

During the year Shell drilled two oil wells and six nonproducers, including two dry exploration wells. The company has plans to drill a wildcat well 9 miles southeast of Maydam Mahzam in an area acquired through the Qatar-Abu Dhabi offshore boundary settlement.

A major portion of the concession area relinquished by Continental Oil Co. of Qatar, Ltd., in 1968 was awarded to the Qatar Oil Co., Ltd., a Japanese company. This company was formed on April 25, 1969, with 17 Japanese firms holding a joint interest in the 7,300-square-kilometer offshore concession. One of these companies, Toa Nenryo Kogyo Co. Ltd., is owned 50 percent by U.S. petroleum companies, marking the first time that U.S. interests have entered a Middle East concession through another foreign-owned company. Terms of the agreement conform to the so-called royalty-expensing formula of the Organization of Petroleum Exporting Countries (OPEC). On December 15, 1969, the Government opened three other areas for bidding, covering 13,400 square kilometers. Geophysical surveys of this area had begun in August 1969.

[14] Prepared by David A. Carleton.

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Table 10.—Qatar: Production of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1967	1968	1969
Crude petroleum	118,083	124,220	129,845
Petroleum refinery products:			
Gasoline	59	• 60	63
Kerosine	32	• 30	33
Distillate fuel oil	52	• 50	50
Residual fuel oil	-------	-------	80
Total	143	• 140	226
Refinery fuel and loss	16	• 10	21

• Estimate.

Table 11.—Qatar: Exports of crude petroleum and imports of petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1967	1968	1969
Exports: Crude petroleum	116,829	124,000	129,598
Imports: Petroleum refinery products:			
Gasoline	251	270	302
Kerosine	27	80	28
Distillate fuel oil	78	137	172
Lubricants	• 12	10	11
Asphalt	r • 50	53	124
Total	r 418	500	632

• Estimate. r Revised.

Total natural gas production in 1969 was 125,687 million cubic feet, of which QPC produced 63 percent and Shell 37 percent. Because of the lack of markets, only 37,290 million cubic feet were consumed as fuel, the remainder being flared. Most of the gas consumed was for use at the Government powerplant and the new cement plant; QPC used small amounts principally as fuel for powering pumpstations.

On May 1, 1969, the new 100,000-ton-per-year cement plant of the Qatar National Cement Manufacturing Co. was inaugurated at Umm Bab on the west coast of the Qatar Peninsula. About 70 percent of the production will be consumed in Qatar, the remainder to be exported mainly to other Persian Gulf countries.

The organization of Qatar Fertilizer Co. was formally constituted in June 1969 as follows: Qatar Government, 63 percent; Norsk Hydro-Elektrisk Kvaelstoff, A.S., 10 percent (with an option for another 10 percent); Hambros Bank, 10 percent; and Power-Gas Corp. Ltd. (a British firm), 7 percent. The plant, which is expected to cost over $62 million, will have a designed capacity of 990 tons of ammonia and 1,100 tons of urea per day; over 100,000 tons of the ammonia will be sold as such each year.[15] Natural gas as a raw material will be piped about 50 miles to Umm Said from the Dukhan field of QPC, which will supply the gas to the line free of charge. The plant scheduled for completion in 1972 will utilize the Mitsui Toatsu Chemical Co., Inc., total recycle process. The entire output is intended for export, primarily to Asian countries.

SOUTHERN YEMEN[16]

Little mineral information has been reported from the Peoples Republic of Southern Yemen since the American Embassy at Aden was closed on October 26, 1969. The only known mineral produced is evaporated salt, most of which is exported. Most of this salt goes to Japan which imported 57,668 metric tons from Southern Yemen in 1969.

The principal mineral activity of the

[15] Fertilizer International. No. 2, August 1969, p. 1.

[16] Prepared by David A. Carleton.

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country is petroleum trading and processing. Much of this activity has been reduced as a result of the Suez Canal closure since 1967 and political and economic conditions in the country. At the end of November 1969, the marketing affiliates of the major international oil companies were nationalized; however, the large Aden refinery of the British Petroleum Co., Ltd., and bunkering activities were specifically excluded by the Nationalization Act.

The Aden refinery, built primarily to produce bunker fuel for ocean vessels, has a 170,000-barrel-per-day capacity. Following the Suez Canal closure, the plant operated at about 65 percent of capacity in 1967 and at about 60 percent of capacity in 1968. With the loss of Egypt's refining capability at Suez early in 1969 the United Arab Republic has arranged to refine at Aden an estimated 50,000 barrels per day of crude oil from the Egyptian fields in the Gulf of Suez. It is believed that the Aden refinery operated at nearly 90 percent of capacity in 1969. Since it now appears that it will be a long time until Egypt's Suez refineries will be operable or until a pipeline is built from Suez to a Mediterranean terminal, the Aden refinery could well continue at this higher level of production for some time.

Southern Yemen agreed late in 1969 to establish an oil company in which the Government would own 51 percent and the Algerian State oil company, Société Nationale pour la Recherche, la Production, la Transport, la Transformation, et la Commercialisation des Hydrocarbures (SONATRACH), 49 percent. The mixed company will engage in all phases of the oil industry but will have exclusive exploration rights only in the former concessionary area of the Pan American Petroleum Co. located in the Fifth and Sixth Provinces (formerly the Hadhramaut and Mahra Provinces). The exploration concession is valid for 5 years following the commencement of initial surveys. In the case of a commercial find, a mandatory, 15-year exploitation concession begins at the time of the discovery. Southern Yemen has reserved the right to issue exploration concessions to others in areas not covered by the protocol. At least one-half dozen oil exploration companies from Western countries have contacted Southern Yemen authorities since the country gained its independence in 1967.

Table 12.—Southern Yemen: Production of mineral commodities

Commodity		1967	1968	1969
NONMETALS				
Salt	metric tons	• 80,000	78,610	• 80,000
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline	thousand 42-gallon barrels	2,840	2,961	NA
Jet fuel and kerosine	do	4,256	4,449	NA
Distillate fuel oil	do	7,370	4,327	NA
Residual fuel oil	do	19,531	17,711	NA
Other, mostly naphtha	do	2,876	4,433	NA
Total	do	36,873	33,881	NA
Refinery fuel and loss	do	3,158	3,794	NA

• Estimate. NA Not available.

Table 13.—Southern Yemen: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
METALS				
Iron and steel		295	256	NA
NONMETALS				
Cement		1,891	282	NA
Salt		82,244	89,701	[1] 57,668
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products: [1]				
Gasoline	thousand 42-gallon barrels	2,735	2,673	NA
Kerosine and jet fuel	do	3,842	4,194	NA
Distillate fuel oil	do	6,151	3,714	NA
Residual fuel oil	do	11,791	14,934	NA
Other, including LPG and feedstocks	do	2,811	4,329	NA
Total	do	27,330	29,844	NA

[1] Apparent. NA Not available.

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Table 14.—Southern Yemen: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
METALS				
Iron and steel		6,810	3,725	NA
NONMETALS				
Cement		37,169	35,518	NA
MINERAL FUELS AND RELATED MATERIALS				
Crude petroleum	thousand 42-gallon barrels	41,245	34,994	• 50,000
Petroleum refinery products: •				
Gasoline	do	244	1,100	NA
Distillate fuel oil	do	224	1,100	NA
Residual fuel oil	do	2,019		NA
Lubricants	do	10	10	NA
Total	do	2,497	2,210	NA

• Estimate. NA Not available.

SYRIAN ARAB REPUBLIC [17]

The mineral industry sector of Syria's economy in 1969 continued to be dominated by petroleum production, as output of crude petroleum almost doubled. However, the foreign exchange earnings from pipeline transit royalties of the Trans-Arabian Pipeline Co. (TAPline) and the Iraq Petroleum Company (IPC) remained in 1969 at the same level as during the previous year, approximately $57 million,[18] because of the stoppage of crude flow in the pipeline.

According to the Syrian Oil Ministry, Syrian crude petroleum production, amounting to about 16.8 million barrels during 1969, was satisfactory. With respect to quality, Syrian crude petroleum from Suwaidiyah and that from Karatchuk tested at 25° and 19° API gravity, respectively, and is suitable for blending with North African light crude; their high-sulfur content of 3.5 and 4.5 percent respectively, is within acceptable limits. Most of the contracts negotiated in 1969 were barter agreements and sales for full price in cash were not made.

The state-owned refinery at Homs expanded its capacity from 1.5 million to 2.8 million tons per year and was adopted to take domestic crude instead of feedstock, which had come primarily from IPC. However, in 1969 very little domestic oil was utilized in the refinery.

The projected expansion of the Syrian pipeline facilities from the northwestern oilfields to the Homs refinery and to the Port of Tartous remained in the planning stage during 1969; however, bids were invited from international companies to undertake the construction. The tenders call for increasing the capacity of the pipelines from 4.5 to 7.5 million tons per year between the fields and Homs, a distance of 566 kilometers, and increasing the capacity of the pipeline from Homs to the port, a distance of 90 kilometers, 4.5 million tons.

A discovery of petroleum was announced in the latter part of 1969 in Northeast Syria at Al Juhaisah but no details were available by the end of the year.

According to the official paper, Al Thawar, about 300,000 tons of phosphate rock were produced and utilized in the production of phosphoric acid in 1969. However, no details on export of phosphate or anticipated future production levels were given. According to the literature, three phosphate fields occur in Syria south of Polmyre where possible reserves of 140 million tons of ore, with an average grade of 24 percent P_2O_5, have been roughly estimated.

The Syrian Press reported that a contract between Syria and the Soviet Union was signed in the latter part of 1969, which provided for the importation of machinery and equipment from the Soviet Union to be used by Soviet technicians in building the Euphrates Dam project beginning in 1970.

[17] Prepared by E. Shekarchi.

[18] Where necessary, values have been converted from the Syrian pound (S£) to U.S. dollars at the rate of S£3.82=US$1.00.

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Table 15.—Syrian Arab Republic: Production of mineral commodities

Commodity		1967 •	1968 •	1969 •
NONMETALS				
Cement	thousand metric tons	600	610	615
Glass sand	do.	10	12	13
Gypsum	do.	15	15	18
Salt	do.	20	20	22
MINERAL FUELS AND RELATED MATERIALS				
Asphalt, natural	metric tons	60,000	60,000	65,000
Petroleum:				
Crude	thousand 42-gallon barrels	------	9,720	16,800
Refinery products:				
Gasoline	do.	1,434	1,361	1,696
Kerosine and jet fuel	do.	1,346	1,276	1,588
Diesel fuel oil	do.	1,842	1,749	2,179
Residual fuel oil	do.	3,067	2,908	3,629
Asphalt	do.	351	332	414
Liquefied petroleum gas	do.	80	NA	NA

• Estimate. NA Not available.

TRUCIAL STATES [19]

The Trucial States are a group of seven independent states (sheikhdoms) consisting of Abu Dhabi, Ajman, Dubai, Fujairah, Ras al-Khaimah, Sharjah, and Umm al-Qaiwain. Each has a special treaty relationship with the United Kingdom, which in 1967 announced its intention to sever these long-term arrangements and withdraw its armed forces from the area by the end of 1971. These seven states plus Bahrain and Qatar announced in February 1968 their plans to form a federation. A constitution resembling the assembly structure is in preparation; however, the lack of agreement at head-of-state meetings could scuttle the proposed federation and create new alignments.

Petroleum is the only major mineral commodity produced in the Trucial States. Large quantities of natural gas are produced in association with crude oil, but because of the lack of markets, essentially all of the gas is either flared, vented or wasted.

Abu Dhabi was joined by Dubai in 1969 as the only sheikhdoms with crude oil production. Petroleum exploration was undertaken in two of the other States, and concessions were either granted or being negotiated at yearend 1969 in all other Trucial States. There are tentative plans for the construction of a small refinery and a natural gas liquefaction plant in Abu Dhabi.

Abu Dhabi.—Crude oil production in Abu Dhabi amounted to 598,900 barrels per day, an increase of about 20 percent over that of 1968. Of this production, Abu Dhabi Petroleum Co., Ltd. (ADPC), the onshore concessionaire accounted for 59 percent and Abu Dhabi Marine Areas, Ltd. (ADMA), the offshore concessionaire, 41 percent. The Government's oil revenues (excluding bonuses and retroactive fees) registered a corresponding increase, rising from an equivalent of $153 million in 1968 to $187 million in 1969. Both companies are engaged in expansion schemes that will increase the country's daily production and export capacity to about 940,000 barrels in the near future. Furthermore, the two fields offshore (Zakum and Umm Shaif) and one field onshore (Murban) will be joined in 1971 or 1972 by at least three more fields. Among these will be ADPC's Abu Jidu (onshore), ADMA's Bunduq (offshore), and the Mubarraz (offshore) field of the Abu Dhabi Oil Co., Ltd. (a Japanese firm).

During 1969 ADPC continued work on a major expansion project started in 1968 to increase production and export capacity of the Murban field to about 520,000 barrels per day. Involved are the drilling of five new wells, the connection of four existing wells, the construction of a third degassing and pumping station, and the laying of another 24-inch line from the field to the Jebel Dhanna terminal where a third tanker loading berth is being built and storage capacity is being increased to about 22,000,000 barrels. Development of the large Abu Jidu field, some 70 miles southeast of Murban will probably begin sometime in 1971–72 with the laying of a pipeline to a point just west of Abu Dhabi town where a deepwater terminal site is

[19] Prepared by David A. Carleton.

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apparently available. The 1969 exploration program included the drilling of one wildcat well at Zubayr and two at Rumaitha.

Production by ADMA, which averaged 243,200 barrels per day in 1969, was provided about equally by the two offshore fields. Daily capacity of Zakum was recently raised to 250,000 barrels and a project, involving additional wells and new handling and storage facilities on Das Island to raise production capacity to 300,000 barrels per day, is currently underway. When completed, the two fields will have a total capacity of 420,000 barrels per day. ADMA is also preparing plans to develop Bunduq field which straddles the Qatar-Abu Dhabi offshore boundary. Development of the field is governed by the March 1969 two-country agreement, which stipulates that ADMA will develop the field and that Government revenues will be divided equally between the two countries. Plans envisage initial production at 30,000 to 40,000 barrels per day with wells tied into export facilities on Das Island. During 1969, the company made three discoveries: Umm Addalkh, 16 miles northwest of Abu Dhabi town; Saath al-Razbut, 28 miles southwest of Zakum field; and Sassan, on the Abu Dhabi side of Sassan structure, which straddles the offshore boundary of Iran and Abu Dhabi.

Three new concessionaires have obtained acreage relinquished by ADPC and ADMA since 1966. The first of these, a group in which Phillips Petroleum Co. is the operator, also includes Ente Nazionale Idrocarburi (ENI) and American Independent Oil Co. (Aminoil). Through 1969, Phillips drilled four wells. One of these, Zayghat tested 880 barrels per day of 25° API crude; however, further study is needed to determine commercial possibilities.

The first exploration well drilled by Abu Dhabi Oil Co., Ltd., a group of three Japanese refining companies, found oil at Mubarraz No. 1 located 40 miles west of Abu Dhabi town. The well tested at 3,000 barrels per day of 33° API gravity crude oil with 1.2 percent sulfur content. A second well 8 miles to the northeast of the first and possibly on another structure tested at 3,000 barrels per day of 41° API crude oil with 0.7 percent sulfur content. Work on production facilities and preparation of an export terminal on Mubarraz Island is expected to begin in 1971.

The third newcomer, Middle East Oil Co., a Japanese company with Mitsubishi Oil Co. Ltd. ownership, obtained a concession in May 1968 and plans a two-well program for the Nahdain area in the western part of Abu Dhabi land area.[20]

Ajman.—At yearend 1969 Occidental Oil Co. was negotiating for a concession covering all the onshore and offshore areas of the enclave which total about 660 square kilometers.

Dubai.—In September 1969, Dubai became the second crude oil producing sheikhdom of the Trucial States. Production from the offshore Fateh field of Dubai Marine Areas, Ltd., averaged 41,306 barrels per day during the last quarter of 1969. Continental Oil Co., operator of the concession, expects daily production to average 95,000 barrels in 1970. Construction of offshore production and export terminal facilities to serve the field were essentially complete at yearend 1969. The complex consists of four multiwell drilling platforms, a central gathering and process platform, and storage tanks that include an innovative undersea storage facility. This unit holds half of the total 1-million-barrel storage capacity of the complex and eliminates the need for port facilities and pipelines to the shore. During the year, six development wells were completed and seismic investigations led to a prospective structure southwest of Fateh. Plans for 1970 call for eight new development wells, additional drilling platforms and storage facilities, and exploratory drilling of the new structure.

No data has been reported on the onshore concession operated by Dubai Petroleum Co. since drilling of the Remah No. 2 well ended in February 1968 after reaching 5,508 feet.

Fujairah.—Activity on the concession held jointly by Shell Minerals, Ltd., and Bochumer Mineralölgesellschaft, G.m.b.H. and Co. (Bomin) was limited to the drilling and abandoning of one dry well and to the completion of one party-month of seismic surveys.

Ras al-Khaimah.—Ras al-Khaimah Oil Co. (80 percent Union Oil Co. of California and 20 percent Southern Natural Gas Co.), holder of the offshore area, finished drilling its first well; however, results have

[20] Middle East Economic Survey. V. 13, No. 13, Jan. 23, 1970, pp. 1–8.

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not been reported. During March 1969, Shell Hydrocarbons, Ltd., concluded an agreement with the ruler for a concession covering 970 square kilometers onshore. Three party-months of seismic surveys were undertaken by Shell during the year.

Sharjah.—On December 20, 1969, the Ruler of Sharjah signed an oil exploration concession with Buttes Gas and Oil Co. (a California firm) and Clayco Petroleum Corp. (a U.S. finance company) covering some 1,800 square kilometers of the Persian Gulf offshore area. The Sharjah offshore acreage was held during 1962–67 by John W. Mecom in conjunction with Union Oil Co. as part of a larger concession comprising the onshore and offshore areas of Sharjah, Ajman, and Umm al-Qaiwain. The one well drilled during that period in Sharjah waters was abandoned without reaching the oil target zone. In January 1969, Shell Hydrocarbons, Ltd., acquired concession rights covering 3,675 square kilometers of onshore area and offshore Gulf of Oman. Seismic surveys by Shell totaled about 5 party-months during 1969.

Umm al-Qaiwain.—During 1969 both the onshore and offshore area of this sheikhdom was granted for petroleum exploration. The onshore area (730 square kilometers) was granted to Shell Hydrocarbons, Ltd., in June and the offshore area (about 2,000 square kilometers) was granted to Occidental Oil Co., in November. Shell completed 2.5 party-months of geophysical and geological surveys during 1969.

YEMEN [21]

Little information is available concerning the production of salt and the importation of petroleum refinery products, Yemen's most important mineral activities. The only specific data on salt production, all of which is exported to Japan, is that 103,206 metric tons of salt with a c.i.f. value of US$1.2 million were imported into Japan from Yemen in 1969.

Exploration for oil and minerals was scheduled to be underway by the end of 1969. Search will be carried out by Yemen Petroleum and Minerals Industries. Co. The company is owned jointly (50–50) by the Yemen and Algerian Governments according to a protocol signed early in 1969. The new company has exclusive rights to explore, exploit, refine, and market hydrocarbons and other minerals throughout the entire republic.

Under the agreement Algeria also undertook to grant Yemen a long-term loan equivalent to $4 million to finance oil and mineral exploration and to cover the cost of Yemen's petroleum refinery products import needs. Operator for the venture will be the Algerian state-owned firm Société Nationale pour la Recherche, la Production, la Transport, la Transformation, et la Commercialisation des Hydrocarbures (SONATRACH). During the year SONATRACH signed a contract with a United States firm to equip a geophysical survey team for work in Yemen.[22]

[21] Prepared by David A. Carleton.
[22] Oil and Gas International. V. 9, No. 7, July 1969, p. 106.

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The Mineral Industry of Other Far Eastern and South Asian Areas

By Staff, Bureau of Mines, Washington, D.C.

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AFGHANISTAN [1]

Afghanistan's only significant contribution to world mineral supply is its natural gas production. An estimated 72 billion cubic feet of natural gas was produced from 24 wells in the Khwaja Gogirdak region of Shibarghan province. Virtually all of the gas was exported by pipeline to the U.S.S.R. as partial payment for Soviet financial and technical aid in developing the gasfields. Production at the fields is planned on a continuing rising scale with exports to the U.S.S.R. expected to reach 150 billion cubic feet by 1973. In 1969, reserves at the Shibarghan fields were estimated at 5.5 trillion cubic feet and the results of present exploration efforts carried out with U.S.S.R. aid imply that the fields may contain as much as 15 trillion cubic feet.

During the year, construction was completed on the industrial complex at Mazar-i-Shariff, which consisted of (1) a 36,000-kilowatt powerplant and (2) a fertilizer complex capable of producing 70,000 tons of ammonia and 105,000 tons of urea annually. Fuel and feedstock for the complex will come via pipeline from the Shibarghan gasfields.

The bulk of Afghanistan's coal needs continued to come from the Karkar and Ishpushta mines having a combined daily production of 500 tons. Half of Karkar's output went to the Ghouri cement plant with the remaining Afghan production sold in Kabul markets. The largest coal mine, however, is said to be the Darri-i-Suf, with reserves of over 60 million tons. Under the present 5-year plan (March 1967 to March 1972) the mine will become the country's major supplier of coal, since both the Karkar and Ishpushta mines are nearing depletion. Although the quality of the Darri-i-Suf coal is somewhat better than elsewhere and the minability of the coal is considered excellent, difficulties will be encountered in its exploitation as the mine is located in a remote area where transportation facilities are poor.

Other mineral commodities produced in 1969 of some importance to the Afghan economy were salt and lapis lazuli, the latter being exported to West Germany. Feasibility studies were continued with French aid on the exploitation of the 2-billion-ton Hajigak hematite deposit, 85 miles northwest of Kabul. Field investigations were being carried out on lead-zinc occurrences in northern Afghanistan, and there was hope that recently detected geophysical anomalies along the eastern side of the country between the Helmand River and the Pakistani border may prove to be major porphyry copper deposits.

[1] Prepared by Ta Cheng Li, mining engineer.

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Table 1.—Afghanistan: Production of mineral commodities [1]

Commodity		1967	1968	1969 p
NONMETALS				
Cement, hydraulic	thousand metric tons	130	e 177	e 180
Gem stones, lapis lazuli	kilograms	5,179	10,000	10,000
Salt, all types	thousand metric tons	31	40	40
MINERAL FUELS AND RELATED MATERIALS				
Coal, bituminous	thousand metric tons	152	200	200
Natural gas, marketed	billion cubic feet	18	53	72

e Estimate. p Preliminary.
[1] All data except 1968 natural gas for Afghan calendar year beginning March 21 of year indicated.

Construction continued on the new cement plant at Herat being built with Czechoslovakian aid. This third plant will help Afghanistan meet most of its cement needs, and will complement the two existing operating facilities at Ghouri and Japal-i-Seraj. For petroleum products, metals, and most nonmetallics, the country continued to depend on overseas sources, chiefly the U.S.S.R.

Table 2.—Afghanistan: Imports of petroleum refinery products
(Thousand 42-gallon barrels)

Commodity	1967–68 [1]	1968–69 [1]
Gasoline	573	749
Kerosine	44	51
Distillate fuel oil	288	355
Lubricants and other	12	14

[1] Afghan calendar year beginning March 21.

BRUNEI [2]

Production of crude oil remained the principal industrial activity of Brunei and was virtually the only mineral produced in 1969. The most significant mineral industry event of the year was the conclusion of a natural gas supply contract between Brunei LNG, Ltd., and three Japanese utility companies—Tokyo Electric, Tokyo Gas, and Osaka Gas. Under the terms of the contract, Brunei LNG, Ltd.—a joint venture of Brunei Shell Petroleum Co., Mitsubishi Shoji Kaisha, and the Brunei Government—will supply 3 trillion cubic feet of natural gas over a 20-year period. The gas will be liquefied prior to shipment at a plant yet to be built, and shipments are planned to start by late 1972. Coldgas Trading Ltd., a joint Shell-Mitsubishi subsidiary, will transport the gas to Japan. Value of the natural gas involved in the contract is estimated at $1.6 billion. Revenues accrued to the Brunei Government from this sale will probably amount to about $12 million a year.

Crude oil production continued to increase during 1969 primarily because of increased output at the Southwest Ampa oilfield. As in past years, virtually all of the crude oil produced was sent by pipeline to Lutong, Sarawak, for refining or reexport.

Brunei's overall trade balance remained favorable during 1968 with exports, including reexports, exceeding imports by $23.4 million. Crude oil exports were valued at $87.6 million or about 95 percent of total exports and reexports from Brunei. In addition to crude oil, Brunei exported to Sarawak $357,000 worth of liquefied petroleum gas and the following amounts of refined petroleum products:

Product	Thousand 42-gallon barrels
Gasoline, all types	399
Kerosine	2
Distillate fuel oil	15
Other	2
Total	418

The only significant 1968 mineral commodity import was iron and steel semimanufactured products amounting to about 26,551 tons and valued at $6.2 million. Principal sources for the imported iron and steel products were Japan (7,539 tons), Singapore (5,191), and Hong Kong (3,954). Brunei also imported 47,250 tons of cement, primarily from Taiwan.

During the year exploratory wells were drilled by Shell Brunei Petroleum Co., Ltd., and the Sun Oil Company group (consisting of the Clark Oil Company, Superior Oil Company, and Sun Oil Company) at their 900-square-mile concession in Tutona Province between the cities of Brunei and Seria. Through yearend, no new discoveries had been reported.

[2] Prepared by Arthur F. Grube, industry economist.

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Table 3.—Brunei: Production of mineral fuels

(Thousand 42-gallon barrels unless otherwise specified)

Commodity	1967	1968	1969
Natural gas, gross production.....million cubic meters •	2,638	3,216	3,491
Liquefied petroleum gas	NA	196	210
Petroleum:			
Crude oil	37,961	44,664	45,624
Natural gasoline	553	535	489
Refinery products:			
Motor gasoline	113	107	108
Naphtha	• 20	19	7
Distillate fuel oil	128	150	184
Residual fuel oil	5	5	4
Total	261	281	303

• Estimate. NA Not available.

CAMBODIA [3]

The Cambodian mineral industry in 1969 apparently produced only small quantities of gold, phosphate rock, limestone, precious and semiprecious stones, salt, cement, and simple construction materials, but output was not officially reported.

The 12,000-barrel-per-day Sihanoukville oil refinery, operated by the Cambodian controlled Société Khumere de Raffinage, was fully operational during 1969. Refinery feedstock was obtained from the Middle East and Indonesia. Although data were not available as to the quantities of petroleum products produced, it was reported that production did cover Cambodian needs and allowed the export of some fuel oil.

Late in 1969, the Cambodian Government granted an exploration permit to the French State Company, Elf-Erap, covering the entire offshore area in the Gulf of Thailand. Under the terms of the agreement, $5.5 million must be invested within the initial 5-year exploration period. The exploration permit can be extended for 5 years. In addition, Elf will have 18 months to conduct its initial surveys before it will be obliged to relinquish half of its permit area.

Because there was a lack of financing, no progress was made in 1969 on the second 5-year development plan, launched in 1967. The plan had called for $9.1 million, $2.3 million of which would go to industrial projects, including (1) a new cement plant with an annual capacity of 200,000 tons; (2) a steel mill using scrap iron to produce wire and concrete reinforcing rods; and (3) a 35,000-ton-per-year urea plant.

Although data on mineral commodity trade for 1968 are not available, it was almost certain that mineral commodity exports remained inconsequential while mineral commodity imports continued to account for a significant share of total trade. Major imports in 1968 probably consisted primarily of iron and steel, cement, and coal. Japan, mainland China, Indonesia, and Singapore are Cambodia's principal trading partners.

CEYLON [4]

Graphite, ilmenite, and precious and semiprecious stones remained Ceylon's principal contributions to world mineral supply. Total value of mineral commodities produced in Ceylon in 1969 was estimated at $25 million. Ceylon produces a very special high-quality type of lump graphite, highly prized in world markets. Graphite production, steady at about 10,000 tons per year during 1966–68, advanced to over 11,000 tons in 1969.

Ceylon's cement industry in 1969 ranked ahead of the graphite industry in value of output and registered a 27.5 percent increase in output over that of 1968 due to the expansion of the new plant at

[3] Prepared by Ta Cheng Li, mining engineer.
[4] Prepared by Ta Cheng Li, mining engineer.

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Puttalam. Ilmenite production in 1969 reached a peak level of 82,851 tons, virtually all of which was exported to Japan. All ilmenite production came from the State-owned Ceylon Minerals Sand Corporation's (CMS) deposit at Pulmoddai, on the northeast coast. At the deposit, the sands extracted are replaced each year by new deposition during the monsoon period, thereby enabling reserves, placed at 4 to 5 million tons, to remain virtually constant. A second CMS ilmenite beneficiation plant located at Trincomalee, 30 miles south of Pulmoddai, was completed in 1969. When fully operative, the plant will enable Ceylon's ilmenite production to reach the 100,000-ton level. The plant will also recover 10,000 tons per year of both rutile and zircon and 500 tons of monazite from the ilmenite tailings.

Ceylon's first oil refinery began commercial operation late in 1969. To be fully operative by 1973, the 38,000-barrel-per-day refinery near Colombo was built at a cost of $35 million and is operated by the Government-owned Ceylon Petroleum Corporation (CPC). Under a 5-year contract signed late in 1968, 90 percent of the refinery feedstock will be supplied by Consolidated Petroleum Supply Company (CPS), a consortium of Royal Dutch Shell and British Petroleum interests. The contract also requires that CPS provide technical assistance in refinery operation and that it purchase any surplus products from the refinery. In an effort to find indigenous crude as feedstock to Ceylon's refinery, the CPC has plans for an oil and gas search in the promising Gulf of Mannar region of northwestern Ceylon. A new $2 million lubricant blending plant, located next to the refinery was also put on stream during the year. Built by the International Cooperative Petroleum Association, the plant has a design capacity of 20,000 tons per year of lubricant products.

Construction on the State Fertilizer Manufacturing Corporation's ammonia and urea plants at Hapagaskande was expected to start early in 1970. The plants will utilize naphtha from the refinery to produce 500 tons of ammonia and 860 tons of urea daily. The plants are scheduled for completion in 1973.

The value of Ceylon's 1969 mineral exports was estimated at $2.5 million of which ilmenite, graphite, and precious and semiprecious stones accounted for about 95 percent. The value of mineral commodities imported in 1969 was estimated at $70 million, of which $28.1 million consisted of petroleum products, $20.0 million of iron and steel products, and $11.1 million of manufactured fertilizers.

Table 4.—Ceylon: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Rare-earth metals, monazite concentrate, gross weight	20	42	56
Titanium:			
Ilmenite concentrate, gross weight	r 53,135	74,605	82,851
Rutile concentrate, gross weight	-------	1,152	2,754
Zirconium, concentrates (zircon), gross weight	r 120	25	68
NONMETALS			
Cement, hydraulic	r 191,760	221,986	283,110
Clays, kaolin	r 2,615	2,867	3,084
Feldspar, crude and ground	256	586	604
Gem stones, precious and semiprecious, except diamond and corundum (exports)—thousand carats	25	196	225
Graphite, all grades (exports)	r 10,366	10,527	11,418
Quartz, glass sand	r 3,324	3,058	3,417
Salt, all types	r 75,804	98,391	113,698
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Refinery products:[1]			
Gasoline—thousand 42-gallon barrels	-------	--------	385
Naphtha—do	-------	--------	211
Kerosine—do	-------	--------	473
Distillate fuel oil—do	-------	--------	873
Residual fuel oil—do	-------	--------	1,381
Other—do	-------	--------	99
Total—do	-------	--------	3,422

r Revised.

[1] Ceylon's first refinery went on stream in mid-1969.

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Table 5.—Ceylon: Foreign trade in mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968
EXPORTS			
METALS			
Rare-earth metals, ores and concentrates (monazite) •		75	NA
Titanium, ores and concentrates (ilmenite)		54,476	73,914
Zirconium, ore and concentrates (zircon) •		100	76
NONMETALS			
Graphite, natural		r 10,394	10,801
Precious and semiprecious stones, except diamond	carats	24,906	196,039
IMPORTS			
METALS			
Aluminum, metal, including alloys, all forms		2,100	2,351
Copper, metal, including alloys, all forms		r 1,268	841
Gold, metal, unworked or partially worked	troy ounces	201	1,273
Iron and steel:			
Metal, pig iron, including cast iron		r 1,013	2,049
Semimanufactures		72,183	92,782
Lead, metal, including alloys, all forms		560	508
Tin, metal, including alloys, all forms		48	54
Zinc, metal, including alloys, all forms		640	1,899
NONMETALS			
Abrasives, natural, n.e.s.		180	207
Asbestos		r 3,735	5,073
Cement	thousand tons	101	183
Fertilizer materials, manufactured:			
Nitrogenous	thousand tons	139	165
Phosphatic	do.	28	29
Potassic	do.	52	56
Other, including mixed	do.	59	85
Salt (excluding brines)		11,200	3,315
Sulfur, elemental, all forms		r 2,191	1,000
Talc		r 1,658	1,161
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades, including briquets	thousand tons	138	42
Coke and semicoke		920	1,294
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	1,505	2,035
Kerosine	do.	1,767	2,051
Distillate fuel oil	do.	r 4,233	6,022
Residual fuel oil	do.	r 1	244
Other	do.	213	106

• Estimate. r Revised. NA Not available.

HONG KONG [5]

Hong Kong is an industrial-commercial area with an economy based on foreign trade rather than on internal resources. A significant portion of this trade includes mineral commodities imported for both local industry and reexport. In 1969 total value of Hong Kong's trade—imports, exports, and reexports—amounted to about $4.6 billion of which about 10 percent involved mineral commodities.

The extractive and processing sectors of Hong Kong's mineral industry contribute little to the colony's economy. Total value of Hong Kong's mining output in 1969 was about $1.4 million, of which iron ore from the Ma On Shan mine in the New Territories accounted for nearly 90 percent. Small quantities of kaolin, quartz, feldspar, graphite, and wolframite were mined for domestic needs and/or for export. In addition cement production based upon imported clinker was valued at $4.0 million. Additional unrecorded values were added by the steel rolling and gas manufacturing industries.

In 1969, Hong Kong exported $18.0 million worth of base metal manufactures, $17.0 million of metalliferous ores and metal scrap, and $6.6 million of petroleum and petroleum products. Mineral commodities imported in 1969 included $160.2 million worth of pearls, precious and semiprecious stones, $76.0 million of petroleum and petroleum products, $51.7 million of iron and steel, and $35.8 million of nonferrous metals.

[5] Prepared by Ta Cheng Li, mining engineer.

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Table 6.—Hong Kong: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1967	1968	1969
METALS				
Iron ore and concentrate	thousand tons	144	162	166
NONMETALS				
Cement, hydraulic	thousand tons	215	259	285
Clays, kaolin		8,570	5,664	4,410
Feldspar		1,153	1,607	1,940
Graphite, all grades		19	505	199
Quartz		3,048	3,693	6,317

Table 7.—Hong Kong: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum, metal, including alloys, all forms	7,317	9,241	United Kingdom 1,998; Taiwan 1,701.
Copper, metal, including alloys, all forms	8,777	10,107	Japan 7,521.
Iron and steel:			
Ore and concentrate, thousand tons	170	171	All to Japan.
Metal, scrap, do	133	127	Japan 56.
Semimanufactures:			
Exports, do	88	90	Thailand 65; Philippines 6.
Reexports, do	30	18	Indonesia 3; Macao 1.
Lead, metal, including alloys, all forms	1,157	709	Taiwan 439; Republic of South Africa 121.
Silver, metal, including alloys, thousand troy ounces	897	1,849	United Kingdom 1,597.
Zinc, metal, including alloys, all forms	467	1,326	Mainland China 1,088.
NONMETALS			
Cement:			
Exports, thousand tons	35	33	Cambodia 18.
Reexports, do	53	20	Brunei 7; Sarawak 5.
Clays and clay products, kaolin	4,900	3,177	Taiwan 1,688.
Diamond, gem, not set or strung, thousand carats	171	162	Belgium 52; Israel 42; United States 17.
Diatomite and other infusorial earths	19	6	India 3.
Feldspar and fluorspar	367	378	Thailand 291; South Vietnam 60.
Graphite, natural	84	256	Indonesia 103; United States 102.
Talc and related materials (soapstone)	750	470	Ghana 380.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline, thousand 42-gallon barrels	22	22	All to Macao.
Kerosine, do	42	40	Do.
Distillate fuel oil, do	249	251	Do.
Lubricants, do	131	124	Thailand 33; Singapore 31; Taiwan 31.
Other [1], do	103	59	Philippines 33.

[1] Mostly waxes.

Source: Hong Kong Census and Statistics Department. Hong Kong trade Statistics. Exports and Reexports. December 1967, 515 pp.; December 1968, 629 pp.

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Table 8.—Hong Kong: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum, metal, including alloys, all forms	15,656	20,885	Canada 5,925; United States 3,982; Japan 3,611.
Copper, metal, including alloys, all forms	13,049	15,512	Japan 6,891; United Kingdom 2,836; Indonesia 1,780.
Iron and steel:			
Ore and concentrates	2,016	------	
Metal:			
Scrap, thousand tons	63	78	United Kingdom 37; West Germany 31.
Pig iron, including cast iron	3,050	8,202	All from North Korea.
Steel, primary forms	27,343	2,224	North Korea 2,180.
Semimanufactures, thousand tons	316	253	Japan 99; mainland China 82.
Lead, metal, including alloys, all forms	675	488	Indonesia 182; United Kingdom 123.
Platinum, thousand troy ounces	48	83	United Kingdom 41; West Germany 32.
Silver, metal, including alloys all forms	252	484	Laos 167; Philippines 112; North Korea 99.
Zinc, metal, including alloys, all forms	5,394	9,316	Canada 3,409; Australia 1,969; Japan 1,504.
NONMETALS			
Cement, thousand tons	515	297	Mainland China 163; Japan 72.
Diamond, gem, not set or strung, thousand carats	457	540	Belgium 199; Israel 140; United Kingdom 68.
Diatomite and other infusorial earths	320	242	United States 183; Japan 38.
Feldspar and fluorspar	2,398	1,298	Mainland China 1,095.
Fertilizer materials, manufactured, thousand tons	8	7	Mostly from West Germany.
Gypsum and plasters, do.	5	23	Australia 15.
Lime, do.	37	29	Mainland China 14; Japan 6.
Salt and brines, salt, do.	33	37	Mainland China 29; Taiwan 4.
Stone and gravel:			
Limestone (except dimension), do.	75	273	Mostly from Japan.
Quartz and quartzite, do.	3,710	3,175	Mainland China 1,988.
Talc and related materials (soapstone)	2,143	1,905	Mainland China 1,331.
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades including briquets, thousand tons	116	78	Mainland China 44; India 16.
Coke and semicoke	5,485	9,479	Mainland China 4,673; Japan 4,300.
Petroleum refinery products:			
Gasoline, thousand 42-gallon barrels	828	780	Singapore 347; Bahrain 256.
Naphthas and solvents, do.	253	229	Iran 127; Singapore 53.
Kerosine, do.	1,446	1,405	Iran 609; Singapore 404; Japan 253.
Jet fuel, do.	1,575	1,921	Singapore 734; Iran 693.
Distillate fuel oil, do.	3,203	3,745	Singapore 1,885, Iran 589; Japan 508.
Residual fuel oil, do.	11,886	12,680	Singapore 4,506; Iran 3,654; Saudi Arabia 3,320.
Lubricants, do.	257	298	United States 88; Taiwan 71, Netherlands Antilles 58.
Liquefied petroleum gas, do.	NA	202	Singapore 58; Philippines 56; Taiwan 45.
Other [1], do.	227	177	Singapore 69; Indonesia 45.

NA Not available.

[1] Mostly waxes and asphalt.

Source: Hong Kong Census and Statistics Department. Hong Kong Trade Statistics. Imports. December 1967, 241 pp; December 1968, 285 pp.

LAOS [6]

Tin remained the only important mineral commodity produced in Laos during 1969. Virtually all production came from the French-managed Phon Tiou tin mines, located in southern Laos. Production of low-grade tin concentrates in recent years has been at the 1,200-ton level.

Laos possesses a variety of other minerals such as coal and iron, which have been of interest, but further studies have been hindered by the country's unsettled conditions.

A 5-year economic plan was launched in 1969 which included plans for the construction of a 50,000-ton-per-year cement plant. However, the financing of the $8 million plant was still to be found.

Value of tin exports in 1969 were estimated at $1,600,000 about the same as in 1968. Most tin concentrates are exported to Malaysia. Laotian mineral imports consist chiefly of petroleum products, cement, and iron and steel semimanufactures. Principal trading partners of Laos are Thailand, Indonesia, and Malaysia.

Aside from the recorded mineral trade, Laos does a lucrative trade in gold, arising from a lack of Governmental restrictions on amounts of gold entering or leaving the country. Gold is imported from West European countries and reexported to Asian countries such as Burma, Thailand, South Vietnam, and India.

[6] Prepared by Ta Cheng Li, mining engineer.

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MONGOLIA [7]

Some progress was evidently made by Mongolia's mineral industry in 1969, as a number of producing sectors and important facilities appeared to have achieved established targets. Official sources reported gains of 15 percent for mining output, 13 percent for power generation, and 17 percent for the construction material industries.

Presently, coal production accounts for an estimated 60 percent of Mongolia's mineral output by value. During the year, coal output increased 10 percent over that of 1968, with the key Sharyn Gol strip coal mine fulfilling an undisclosed goal. Annual output from the mine is believed to be 800,000 tons and expansions are planned to bring output to 1 million tons. As in most years, Nalaikha, the country's only other important coal mine, failed by a wide margin to reach its target.

The important construction materials sector was credited with only having fulfilled about four-fifths of its goals. This allegedly was because neither the lightweight concrete mixing plants nor the new cement plant at Ulan Bator met their quotas. Annual capacity of the cement plant is presently being expanded by 100,000 tons with completion expected by 1970.

All fluorspar and tungsten output, Mongolia's only mineral export items of consequence, is shipped to the Soviet Union. Fluorspar production reportedly increased 7 percent over 1968 and probably reached at least the 75,000-ton level. Tungsten output, however, from the main Burentsogt and Ih Hairhan mines, reportedly was only 60 percent of the planned targets. Increasingly difficult mining conditions encountered at both mines were apparently responsible for their failures to reach targets.

No official Mongolian trade data are published. However, because at least 80 percent of total Mongolian trade is with the U.S.S.R., officially recorded Soviet trade statistics are believed highly indicative of total Mongolian mineral commodity trade. Soviet imports of Mongolian fluorspar were given as 46,500 tons in 1967 and 67,500 tons in 1968. Small amounts of ferrous scrap and unspecified nonferrous ores and concentrates (undoubtedly including tungsten) were also imported by the U.S.S.R. from Mongolia. Exports to Mongolia in 1967 and 1968 included iron and steel products (12,300 tons and 17,300 tons, respectively) as well as small amounts of nonferrous metals, refractories, and coal and coke. Cement shipments, totaling 50,000 tons in 1967 and 48,000 tons in 1968, will probably be reduced to relative unimportance by 1970 with the completion of expansion plans at the Darkhan cement plant. The supply of crude oil to keep the small Dzuun Bayan refinery operating at full capacity and petroleum products, which account for the greater part of indigenous demand, remain the principal Soviet trade contribution to the Mongolian mineral economy. Together these totaled about 1.8 million barrels in 1967 and 1.9 million barrels in 1968.

[7] Prepared by Ta Cheng Li, mining engineer.

Table 9.—Mongolia: Estimated production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity [1]		1967	1968	1969
NONMETALS				
Cement, hydraulic		50	75	120
Fluorspar, all grades		50	r 70	75
Gypsum		r 20	25	25
Lime (quicklime and hydrated lime)		r 35	40	40
Salt, all types		8	8	8
MINERAL FUELS AND RELATED MATERIALS				
Coal [2]		r 1,008	1,250	1,400
Petroleum:				
Crude oil	thousand 42-gallon barrels	90	90	90
Refinery products:				
Gasoline	do.	165	165	165
Distillate fuel oils	do.	55	55	55
Residual fuel oil	do.	220	220	220

r Revised.

[1] In addition to listed items, Mongolia produces simple construction materials and small amounts of tungsten concentrates.

[2] Mainly so-called brown coal.

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NEPAL [8]

The 54,362-square-mile Kingdom of Nepal remained inconsequential in terms of mineral production and consumption in 1969 and was virtually without an organized mining industry. A 20,000-ton-per-year steel rolling mill erected at Simra in 1964 to process imported billets apparently has not operated since its closure in 1967 because of inadequate local markets. The private Nepalese owner of the rolling mill hoped to reopen the facility by yearend 1969 to meet an anticipated demand for concrete reinforcing rods. However, there were no reports confirming this reopening, which was expected to occur as a result of the opening late in the year of a 175-ton-per-day cement plant, also at Simra. This facility, built by the owner of the steel mill, was financed in part by a loan from the Nepal Industrial Development Corp. and was expected to meet the bulk of the nation's existing requirement for cement, heretofore imported from India, and totaling about 60,000 tons per year in recent years.

Anticipating further growth in Nepalese cement demand, Birla Brothers, an Indian cement firm, reportedly was considering construction of a plant in Nepal at an unspecified location in Kathmandu Valley, but there was no indication in the press through yearend 1969 that any work had started.

Indigenous mineral deposits operated to meet a part of local demand for minerals and metals include a few small iron deposits that supply charcoal-fired clay furnaces with raw materials to produce a low-quality iron; some very modest copper mines that supply low-grade metal to local producers of ornaments and utensils; and the usual range of construction material quarries (clays, stone, and sand and gravel).

In the past, cobalt had been recovered at several locations, both from ore bodies in which cobalt is dominant and from deposits of copper and nickel that also contain cobalt. Reserves are unknown, but there was some interest in these metal occurrences by foreign (United States and Japanese) interests during 1968 and 1969. Similarly, sporadic localized production of lead-zinc ores, beryl, placer gold, graphite, mica, ochers, quartz crystal and talc have been reported, but as of 1969, only talc was assuredly being produced, this from the Palung deposit, about 45 miles south of the capital of Kathmandu, owned by Nepal Mines and Chemical Company. The talc is cut into bricks and marketed in Calcutta, India, for basic furnace linings.

No statistical data on Nepalese mineral production, trade, and consumption are available other than the previously cited cement consumption figure and data on estimated major petroleum product use, which aggregated 10.9 million barrels for the year ending July 15, 1969, an increase of slightly more than 100 percent over the 1962 figure, and including 2.6 million barrels of motor gasoline, 5.6 million barrels of kerosine, and 2.7 million barrels of distillate fuel oil (with no information on aircraft fuels, residual fuel oils and lubricants, all presumably consumed in small quantities). Petroleum products are all imported from India.

SINGAPORE [9]

Singapore's economy achieved new highs during 1969. Foreign trade and shipping ended the year at record levels and industrialization continued its dramatic growth. Gross domestic product increased from $1,419 million in 1968 to an estimated $1,611 million in 1969. During the same period, overall foreign trade-exports and imports went from $2,932.8 million to $3,589.6 million.

The search for oil in Southeast Asia has resulted in Singapore becoming a regional base for petroleum-related activities. Scores of oil companies, geophysical surveyors, drilling firms, and specialized construction companies have established branches in Singapore. The immediate effect of this activity on the Singapore economy cannot be measured but it is evident that millions of dollars are flowing to local firms for the construction of barges, pontoons, tugs, houseboats, supply ships, and specialized

[8] Prepared by Charles L. Kimbell, physical scientist.
[9] Prepared by Arthur F. Grube, industry economist.

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workboats to be used in Indonesia and elsewhere in Southeast Asia. Additionally, local firms are providing steel tanks, pipe, cement, chemicals, and food and water to the oil companies operating in the area.

The International Bank for Reconstruction and Development granted a loan of $20.5 million to the Public Utilities Board of Singapore to finance major electric power development projects, including addition of 430,000 volt-amperes of primary and 650,000 volt-amperes of secondary distribution transformers together with installing 250 miles of cable, and additional switchgear, and substation equipment. Singapore's production of electric power amounted to 1,652 million kilowatt-hours during 1969.

PRODUCTION

Singapore's mineral output, as in past years, consisted of refined oils, steel products, cement, and granite mined for local construction. Cement production amounted to 471,000 tons in 1967, 566,501 tons in 1968, and 622,822 tons in 1969. Refinery output for the 1967–69 period was as follows in thousand 42-gallon barrels:

Product	1967	1968	1969
Gasolines and naphthas	5,874	16,924	17,258
Kerosine and jet fuel	4,412	1,981	2,247
Distillate fuel oil	7,329	11,624	11,678
Residual fuel oil [1]	17,568	32,119	33,763
Other	779	1,164	1,846
Refinery fuel and loss	1,076	1,467	1,238
Total	37,038	65,279	67,530

[1] Includes unfinished fuel oils.

TRADE

The overall value of Singapore's 1968 trade was $2,933 million with exports accounting for $1,272 million and imports for $1,661 million. As in past years, trade in crude oil, refined petroleum products, and semimanufactured iron and steel products were the most significant. The value of these commodities in 1968 was as follows in million dollars:

Commodity	Exports	Imports
Crude oil	$151	$117
Refined petroleum products	264	163
Semimanufactured iron and steel	16	41

COMMODITY REVIEW

Metals.—*Iron and Steel.*—The National Iron and Steel Mills announced further expansion plans during 1969. These plans include the addition of a third electric furnace; a three-strand continuous casting unit with a capacity of 80,000 tons per year; and a blast furnace with a capacity of about 300,000 tons per year. The company which produces about 110,000 tons per year of steel products plans an eventual capacity of 300,000 to 400,000 tons per year.

Mineral Fuels.—*Petroleum.*—During 1969 Singapore continued on the road to becoming an important refining center. A new refinery, currently under construction, is expected to go on stream by the end of 1970. The refinery, located on Ayer Chawan Island, is being constructed for Esso Standard Eastern and will have a capacity of 80,000 barrels per day. Another new refinery is being planned by a consortium consisting of two American companies, Standard Oil Company (Indiana) and the Summit Industrial Corp., and the Singapore Government's Development Bank. Plans include the construction of a 60,000-barrel-per-day refinery, to be built adjacent to the Esso plant.

The two existing refineries have announced expansion projects planned for completion by late 1970. The first, Shell Eastern Petroleum Ltd., will increase the daily capacity of the Pulau Bukom refinery from 135,000 to 220,000 barrels per day. Similarly BP Refinery Singapore Ltd. announced a $3.3 million expansion program for its refinery at Pasix Panjang. The capacity of this refinery will be increased to 25,000 barrels per day.

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Table 10.—Singapore: Exports and reexports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
METALS			
Aluminum, all forms	585	830	Malaysia 755.
Copper:			
Ore and concentrate	1,270	1,270	All to Japan.
Metal including alloys, all forms	726	706	Malaysia 687.
Iron and steel:			
Ore and concentrate	8,439	26,645	Japan 21,845.
Metal:			
Scrap	3,531	602	Malaysia 451.
Pig iron and ferroalloys	1,480	937	Malaysia 549.
Ingots and other primary forms	1,118	3,318	Malaysia 2,050; Cambodia 1,182.
Semimanufactures	112,853	107,619	Malaysia 64,905; Cambodia 13,244.
Lead, all forms	446	696	Malaysia 400; Denmark 159.
Manganese ore and concentrates	1,767	2,082	Malaysia 1,956.
Silver, unworked...thousand troy ounces	1,886	3,541	All to United Kingdom.
Tin:			
Ore and concentrate...long tons	2,760	3,545	All to Malaysia.
Slag and hardhead...do	217	-------	
Other forms...do	803	142	Malaysia 92.
Zinc, all forms	1,510	2,412	Malaysia 1,731; Cambodia 668.
NONMETALS			
Cement and clinker	31,131	11,109	Brunei 3,454; Christmas Island 2,453; Malaysia 2,272.
Fertilizer materials:			
Crude, natural phosphates	22,160	17,254	Malaysia 15,933.
Manufactured, all forms	79,176	109,461	Malaysia 62,071; Burma 42,252.
MINERAL FUELS AND RELATED MATERIALS			
Coal, all types	87	24	Malaysia 13.
Coke	957	981	Malaysia 865.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	-------	83	All to Burma.
Refinery products:[1]			
Aviation gasoline...do	2,585	2,855	South Vietnam 1,897; Thailand 642.
Motor gasoline...do	7,404	9,576	South Vietnam 4,578; Japan 1,745; Malaysia 1,152.
Kerosine...do	2,677	2,734	South Vietnam 1,565; Hong Kong 438.
Jet fuel...do	14,936	16,300	South Vietnam 8,921; Thailand 4,686.
Distillate fuel oil...do	12,990	17,392	South Vietnam 6,772; Thailand 2,431; Hong Kong 2,043.
Residual fuel oil...do	20,860	26,660	Japan 15,777; Hong Kong 4,395; South Vietnam 3,307.
Lubricating oils...do	702	810	Thailand 284; Malaysia 256; Burma 110.
Asphalt...do	342	502	Malaysia 123; Thailand 118; South Vietnam 83.
Other...do	51	129	Malaysia 31; Hong Kong 26; Philippines 19.
Total...do	62,547	76,958	
Bunkers:			
Aircraft...do	546	611	NA.
Ships...do	22,857	26,406	NA.

NA Not available.

[1] In addition to products listed, liquefied petroleum gas valued at $453,000 in 1967 and $788,000 in 1968 was also exported.

Source: Singapore Department of Statistics. Singapore External Trade Statistics, 12 months ended December 1967 and 12 months ended December 1968.

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Table 11.—Singapore: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1968
METALS			
Aluminum:			
Bauxite	300	699	All from mainland China.
Metal and alloys, all forms	3,254	4,914	Japan 1,761; Hong Kong 909.
Copper:			
Ore and concentrate	1,016	508	All from Malaysia.
Metal and alloys, all forms	r 2,254	2,585	Japan 1,345; Australia 535; United Kingdom 267.
Iron and steel:			
Metal:			
Iron and steel scrap	35,826	24,688	Malaysia 21,430; Australia 1,337.
Pig iron and ferroalloys	22,540	21,239	U.S.S.R. 17,362; mainland China 1,800.
Ingots and other primary forms	22,813	28,259	Australia 15,417; Japan 3,841.
Semimanufactures	261,216	309,435	Japan 209,268; United Kingdom 26,769.
Lead, all forms	605	770	Australia 307; Japan 237; United Kingdom 116.
Manganese ore and concentrates	4,097	9,062	Unspecified African countries 8,721.
Silver, unworked troy ounces	14,028	267,362	Malaysia 201,229; United States 50,922.
Tin:			
Ore and concentrates long tons	1,446	1,241	Malaysia 1,197.
Other forms do	627	421	Malaysia 314; United Kingdom 71.
Zinc, all forms	4,835	8,607	Japan 5,495; Canada 1,220.
NONMETALS			
Cement and clinker	485,725	553,820	Japan 220,592; Malaysia 180,338; Taiwan 148,059.
Fertilizer materials:			
Crude, natural phosphates	18,849	15,824	Christmas Island 7,657; United States 6,300.
Manufactured, all forms	102,008	94,749	United States 51,608; West Germany 20,471.
MINERAL FUELS AND RELATED MATERIALS			
Coal	79	3,852	India 3,699.
Coke	4,356	5,151	West Germany 2,446; Taiwan 1,235.
Petroleum:			
Crude and partly refined:			
Crude thousand 42-gallon barrels	38,257	63,492	Kuwait 51,321; Iran 7,834.
Partly refined do	1,939	2,307	Mostly from Malaysia.
Refinery products:			
Aviation gasoline do	2,870	3,162	Iran 2,000.
Motor gasoline do	4,530	4,467	Malaysia 1,565; Iran 1,262; Australia 680.
Kerosine do	2,321	2,144	Malaysia 1,832; Bahrain 107.
Jet fuel do	11,719	7,837	Malaysia 4,896; Iran 1,387.
Distillate fuel oil do	8,397	9,985	Kuwait 4,194; Philippines 1,683; Malaysia 1,475.
Residual fuel oil do	23,260	24,262	Malaysia 13,150; Saudi Arabia 2,762; Iran 2,243.
Lubricating oils do	839	1,065	Netherlands Antilles 562; Japan 193; United States 114.
Asphalt do	20	39	Malaysia 19; Netherlands 11.
Petroleum coke do	428	17	All from India.
Other do	22	25	United States 9; Burma 4; United Kingdom 3.
Total do	54,406	53,003	

r Revised.

Source: Singapore Department of Statistics. Singapore External Trade Statistics, 12 months ended December 1967 and 12 months ended December 1968.

NORTH VIETNAM [10]

The North Vietnam economy remained on a wartime footing throughout 1969 despite the cessation of American bombing in mid-1968. Efforts were devoted to the rehabilitation of local industry to satisfy, as far as possible, domestic requirements. As a result, many sectors such as coal, engineering, and electricity claimed that production was maintained at a "substantial level."

North Vietnam possesses significant resources of anthracite coal and it was claimed that "over 10" new coal-mining areas were exploited in 1969. The bulk of the country's coal production has come from the well-known Hongay mines. Before bombing damaged the mines, annual production was close to 3.5 million tons.

[10] Prepared by Ta Cheng Li, mining engineer.

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War damage brought output down considerably in 1967 and total recovery apparently has not been achieved as official statements have suggested that coal production had fallen far behind target for 1969. Surplus anthracite has gone abroad, with Japan importing 251,565 tons in 1969.

Production of iron ore and steel, about 300,000 tons and 150,000 tons, respectively, prior to the bombing, probably has been fairly small in recent years since there is no indication that the Thai Nguyen Iron and Steel Works have been rehabilitated.

The country's cement industry achieved a production high of 750,000 tons in 1967, but output in 1969 probably was not much more than half a million tons. North Vietnam also has mines producing 32,000 tons of chrome ore (from Co Dinh) and 1.2 million tons of apatite (from Laokay). Small quantities of tin ore were produced at the Cao Bang tin mine. There is also a small zinc refinery at Quang Yen, which gets its ore supply from the Cho Dien mine. Zinc production at the smelter used to be 10,000 tons per year.

SOUTH VIETNAM [11]

The mineral industry of South Vietnam remained static during 1969 because of wartime difficulties. Production was limited to relatively small quantities of cement, salt, clay, and sand. Continuous unrest and political instability has precluded thorough geological surveys to determine the nature and extent of the country's mineral resources.

The country's cement production in recent years has been as follows: 180,756 tons in 1967, 144,708 tons in 1968, and 247,185 tons in 1969. Most of the cement comes from the Ha Tien-Thu Duc cement plant on the Gulf of Siam. Reportedly, an extension of the cement plant was being planned with the help of a French loan. The country's demand for cement far exceeds supply, necessitating large imports. Imports amounted to 476,213 tons in 1967 and 307,534 tons in 1968, most of which came from Taiwan.

With limited facilities to manufacture steel products, South Vietnam relies almost entirely upon imports. Imports of steel products amounted to 232,996 tons in 1967 and 103,654 tons in 1968. A small steel mill producing 20,000 tons per year of round bars was completed late in 1969 at Bien Hoa at a cost of $3.5 million. The plant will use iron scrap which was previously exported to Japan.

South Vietnam has no refinery, although a 40,000-barrel-per-day plant has been proposed for Nha Trang. Meanwhile, all needs were met by imports of refined petroleum products. Principal oil products imported were as follows, in thousand 42-gallon barrels:

Product	1967	1968
Gasoline, all types	1,349	1,666
Kerosine	1,251	1,845
Distillate fuel oil	1,427	1,692
Residual fuel oil	1,962	2,166

Construction on the fertilizer plant at An Hoa, 40 miles southwest of Danang, has made no significant progress since 1966. Equipment for the plant, stored in Saigon for several years, had been financed by a French loan of $14 million and a West German loan of $12 million. There were reports that Hitachi Shipbuilding and Engineering Co. was involved with talks concerning the export of a large fertilizer complex which is to be constructed near Saigon for the Industrial Development Corp. of South Vietnam. The proposed plant will produce 600 tons per day of ammonia and 1,000 tons per day of urea. Meanwhile, fertilizer imports have risen from about 35,000 tons in 1966 to more than 300,000 tons in 1969.

[11] Prepared by Ta Cheng Li, mining engineer.

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The Mineral Industry of Other South Pacific Islands

By John A. Stock [1]

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BRITISH SOLOMON ISLANDS

Despite the increasing mineral activity in the British Solomon Islands Protectorate (BSIP), there is as yet no producing mineral industry. A small amount of gold has been produced yearly by natives from alluvial deposits situated mostly on Guadalcanal Island. In addition to Guadalcanal, the BSIP consists of six other principal islands (Choiseul, New Georgia, Santa Isabel, Malaita, San Cristobal, Santa Cruz) and many smaller islands extending southeastwards about 1,600 kilometers from Bougainville Island.

Gold output ranged between 310 and 672 troy ounces from 1965 to 1967, and amounted to 654 ounces in 1968. Production for 1969 is not available. Mineral exports for 1968 include all the gold (valued at $19,870 and shipped to Australia) and scrap metal (valued at $70,683 and shipped mainly to Hong Kong). Mineral commodity imports in 1968 were valued at about $1.3 million, of which more than 70 percent went for mineral fuels.

In 1969 an extensive mineral survey, financed jointly by the Government and the United Nations Development Programme, was completed. The survey, extending over 3 years, began with a variety of airborne geophysical techniques, followed by intensive, detailed aerophysical studies, photogeological studies, and followup ground surveys. The ground surveys included detailed geological mapping, geochemical and geophysical tests, and some drilling. Two promising prospects were outlined: Bauxite on Rennell Island and low-grade copper on Guadalcanal. These two were subject to development proposals through March 1969 and resulted in Mitsui Mining and Smelting Co. obtaining a prospecting license for Rennell Island and Utah Construction & Mining Co. obtaining one for Guadalcanal. Mitsui can hold its license on the area of western Rennell until 1971 and has been test pitting and sampling the deposit, which is reportedly of good grade (47 to 48 percent alumina) and at least 36 million tons. Traces of uranium oxide occur in the bauxite which may be a valuable byproduct. Mitsui expects to decide if the deposit is commercial by mid-1970. Utah Construction prospected on the Copper Ridge at Kouloula, Guadalcanal, during 1969.

Other areas investigated during the geophysical surveys were opened to prospecting at the same time as Rennell and Guadalcanal Islands. Other companies are prospecting for bauxite on Three Sisters, Santa Cruz, San Cristobal, and other islands. Amax Bauxite Corp. of Australia Ltd. originally obtained a license to prospect a large portion of Santa Cruz but withdrew

[1] Mining engineer, Bureau of Mines, Washington, D.C.

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its application when the company discovered large bauxite deposits in Australia. Conzinc Rio Tinto of Australia began prospecting on a special license area. International Nickel Southern Exploration Ltd. (Insel) has been extensively prospecting the leases it already holds on Santa Isabel, where an extension of a known manganese deposit was located; on San Jorge, where a nickel sulfide vein was outlined by the aerial surveys; and the whole of the islands of Horare, Tanabuli, Sisagara, and Kolare. Kilakana Plantations of Honiara Island applied for a mining lease in the Gold Ridge area of Guadalcanal.

CHRISTMAS ISLAND

The only commercial activity on Christmas Island, an Australian territory in the Indian Ocean, is the extraction and export of bulk phosphate rock and bagged phosphate dust. The several phosphate deposits are owned equally by the Australian and New Zealand Governments and comprise reserves of about 200 million tons. Since mid-1968, the Christmas Island Phosphate Commission (CIPC) has been handling the purchase, stockpiling, and distribution of the phosphate output, but the British Phosphate Commissioners (BPC) have been retained as managing agents. Most of the output is exported to Australia and New Zealand for agricultural purposes. Exports of rock and dust for the last 3 years, by destination, are as follows, in metric tons:

Fiscal year ending June 30 of year stated	Australia	Cambodia	Singapore and Malaya	New Zealand	Total
1967	808,725	-----	96,826	208,113	1,113,664
1968	891,454	-----	70,674	183,759	1,145,887
1969 [1]	804,255	7,503	106,339	259,347	1,177,444

[1] Calendar year.

Exports were valued at about $1.3 million in 1969, but import data are not available. In past years more than half the tonnage of imports consisted of fuel oil and gas oil.

FIJI ISLANDS

Situated nearly 2,700 kilometers east-northeast from the coast of Australia, the Fiji Islands comprise about 800 islands and islets and have been a British colony for 96 years. About 100 of these islands are permanently inhabited by approximately 500,000 people, and it is expected that by October 1970 Fiji will become an independent nation. Viti Levu and Vanua Levu, the two largest islands, have areas of about 10,400 and 5,500 square kilometers, respectively.

Mineral production in 1969 was valued at about $6.5 million,[2] of which 59 percent was accounted for by gold. During the year exports of mineral commodities were valued at over $4.6 million, and mineral imports totaled $12.5 million. About $10.7 million of mineral imports went for mineral fuels and steel semimanufactures.

[2] Where necessary, values have been converted from Fiji Dollars (FD) to U.S. dollars at the rate of F1=US$1.136.

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Table 1.—Fiji: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969
METALS			
Copper, mine output, metal content	2	r • 610	366
Gold, mine output, metal content—troy ounces	111,028	106,784	91,572
Manganese, ore and concentrate, gross weight	5,939	8,554	20,790
Silver, mine output, metal content—troy ounces	61,385	54,518	37,951
NONMETALS			
Cement, hydraulic	47,373	51,396	54,563
Lime	2,821	3,374	4,477
Stone and sand and gravel:			
Limestone—cubic meters	[1] 11,661	1,315	19,025
Quarried stone, other—do	275,882	212,909	243,699
Sand and gravel—do	295,613	• 306,000	[1] 415,628
Sand (coral)—metric tons	59,868	62,459	67,592

• Estimate. r Revised.
[1] Quantity in metric tons.

Table 2.—Fiji: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
Copper, ore and concentrate	1	3,292
Gold (in bullion)—troy ounces	112,698	106,784
Manganese, ore and concentrate	4,430	10,574
Nonferrous base metal scrap	8	6
Silver [1]—troy ounces	61,690	54,419

[1] Contained in gold bullion.

Table 3.—Fiji: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum, metal, including alloys, semimanufactures	39	55
Copper, metal, including alloys, semimanufactures	48	76
Lead, metal, including alloys, semimanufactures	69	60
Tin, metal, including alloys, semimanufactures—long tons	179	284
Steel:		
Primary forms	294	275
Semimanufactures	r 13,508	18,519
Other, nonferrous metals, including alloys, semimanufactures	114	147
NONMETALS		
Cement	354	529
Fertilizer materials	24,252	33,199
Salt (including brines)	1,992	2,354
MINERAL FUELS AND RELATED MATERIALS		
Coal	5,691	2,058
Coke	174	278
Petroleum refinery products:		
Gasoline and benzene—thousand 42-gallon barrels	263	283
Kerosine and jet fuel—do	574	616
Diesel oil—do	r 518	591
Residual fuel oil—do	135	179
Lubricants—do	19	19
Other, bitumen—do	12	7

r Revised.

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During 1969, the Fiji Geological Survey engaged in geochemical and geological mapping of various islands and areas of islands of the Fiji group. Mapping on Vanua Levu included the Savusavu area, the Ndreketi Basin area in the center, and the Mbua shield volcano and plateau on the western end of the island. Other smaller islands mapped were Ovalau, Koro, Moturiki, Wakaya, and Kioa. An assessment of the reserves of the Nambu manganese mine and phosphate deposits in the Lau group as well as investigations of minor mineralization on Nggamea and Waya Islands was also made.

Offshore exploration by Crawford Marine Specialists, Inc. was continued near Vanua Levu and Viti Levu. The Government entered into two onshore exploration agreements during the year: One with Barringer Research of Canada, and one with Dr. B. Campana, a consulting geologist of Switzerland. Each party will finance its own investigations, but will be compensated with mining leases to successful finds. Initially, Barringer was to have sole prospecting rights, except for existing valid claims, on Viti Levu and Vanua Levu for 1 year starting in early 1969. After March 1970, Barringer will release most areas and select smaller areas for an additional 3 years of prospecting. During the first year Barringer plans to engage in regional airborne reconnaissance, testing new applications of radio waves employing electrical and magnetic instrumentation, and geochemical and surface inspection of geologic structures. Dr. Campana has a 10-year agreement, presumably to start after March 1970, to explore for bauxite, manganese, and phosphate on all the islands. The Government will be able to participate up to 50 percent in any mineral development, and financing will probably come from Government and other sources for the exploitation of any finds.

Emperor Gold Mining Co. Ltd. produced and milled less gold ore through the fiscal year ending June 1969 than it had the previous year. During this latest fiscal year, 98,245 ounces of gold was produced, a reduction of about 9 percent from the previous fiscal year. Reportedly, the cause of reduced production was the decline of the free market price of gold from $43.50 in May to the parity price of $35 per ounce in early December. Net operating loss was about $320,000, but after taking Government assistance and deferred expenditures, a net profit of $138,000 was made. Bauxite Fiji Co. Ltd. is planning a $2.5 million open pit bauxite mine despite discouraging experiences with copper mining on Vanua Levu. The bauxite deposit is estimated at 6 million tons, and the company plans shipments of 250,000 tons annually to Japan starting in 1972. Southland Mining Ltd. has reportedly found additional manganese ore in a new license area. The company also has recently acquired manganese properties on northwest Viti Levu.

The Government is planning new legislation to amend Fiji's Oil Mines Ordinance to provide more control over offshore areas and also plans to modernize rules governing land exploration. The discovery of oil seeps in Tonga has raised interest in the possibility of finding oil in the Lau Islands of Fiji.

NAURU AND OCEAN ISLAND

Phosphate rock mining and export are the sole economic activities of the Republic of Nauru and Ocean Island in the British Gilbert and Ellice Islands Colony. Operation and management of the industry for both islands have been under the British Phosphate Commissioners (BPC), but since the islands attained independence in January 1968 the Nauru Phosphate Commission (NPC) has been acquiring the assets as well as the control and marketing of its industry. According to agreement, valid until 1970, NPC will supply the BPC with rock under its former preferential price arrangement and will supply only the member countries of Australia, New Zealand, and the United Kingdom. An exception was made by the BPC in 1968 to allow the sale of excess phosphate to Japan. Again in 1969 Nauru shipped about 260,000 tons of phosphate rock to Japan because of an excess in Australia and New Zealand caused by droughts over the last 2 years. Production, all exported, from both islands for the past 3 years is as follows:

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Year	Thousand metric tons		
	Nauru	Ocean Island	Total
1967	1,798	452	2,250
1968	2,254	528	2,782
1969	2,198	564	2,762

In September 1969, after heated and prolonged negotiations between the Nauruans and BPC, during which Nauru threatened to sell directly to Australian manufacturers and Australia threatened import restrictions, Nauru won a 2.5-percent price increase for rock supplied to the BPC. Starting in fiscal year 1970–71, the new price will be $13.56 per metric ton f.o.b. for 1.8 million tons; in the following year 1.4 million tons will be sold at a price to be negotiated. Shipments will be in ships owned or chartered by Nauru, and Nauru can sell to other customers on a regular basis.

Phosphate rock reserves on Nauru were estimated in mid–1967 by the BPC to total 58.9 million metric tons and at the current extraction rate should last about 25 years. It is estimated that Ocean Island will be depleted of phosphate rock by 1981.

NEW CALEDONIA

The island of New Caledonia, an overseas territory of France located in the South Pacific Ocean, is the second largest nickel producer in the free world after Canada. Mining was started in 1875 and has continued since that time, principally by the French company Société Anonyme Le Nickel of the Rothschild group. In the last 15 years, Le Nickel's output of ore has increased from less than 500,000 to over 3 million tons, and the remainder is made up by a number of small operators. In 1968 a record tonnage of ore was produced from the island, with an annual increase of 37 percent. A new record tonnage was also attained in 1969, but at a lesser rate of increase (4 percent). New projects are underway which will further exploit the large nickel deposits of New Caledonia and enhance its role as a major supplier of the metal in the free world.

PRODUCTION

Except for a small amount of giobertite which is used locally as a refractory, mineral production consisted entirely of nickel ore and smelter products of nickel. Anticipation that the nickel industry of New Caledonia would establish another record output in 1969 was satisfactorily realized, although the rate of increase was much less than in 1968. Ore produced during 1969 contained an estimated recoverable nickel-cobalt content of about 90,500 metric tons and was valued at about $75 million.[3] Nickel smelter products were valued at about $84 million.

[3] In August 1969, the cFP franc (cFPF) was devalued from cFPF 90=US$1.00 to cFPF 101=US$1.00. To compensate for the near midyear change, values given herein have been converted at the prorated value of cFPF 95=US$1.00.

Table 4.—New Caledonia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	1969 p
METALS			
Chromite (51 to 53 percent chromium oxide)	1,238	------	------
Iron ore (55 to 56 percent iron)—thousand tons	204	172	------
Nickel:			
Ore [1]—do	3,820	r 5,303	5,520
Metallurgical products: [2]			
Ferronickel (nickel-cobalt content)	20,656	22,425	23,886
Matte (nickel-cobalt content)	13,840	14,894	15,909
NONMETALS			
Giobertite [3]	1,558	664	192

p Preliminary. r Revised.
[1] Mine-run ore, about 25 percent water; nickel content 2.8 to 3.5 percent by dry analysis.
[2] Ferronickel grading 24 to 28 percent nickel-cobalt, matte about 79 percent nickel-cobalt.
[3] Magnesium mineral used for refractories.

Source: Mines Service of New Caledonia.

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Table 5.—New Caledonia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
Iron ore	197,555	------
Nickel ore thousand tons	2,489	3,093
Smelter products: [1]		
Ferronickel:		
Electric grade (FN4 grade, 25.1 percent nickel-cobalt)	10,098	8,467
Sulfur extracted (FN3 grade, 24.5 percent nickel-cobalt)	3,872	5,764
Refined (FN2 grade, 26.3 percent nickel-cobalt)	351	411
Overrefined (FN1 grade, 27.5 percent nickel-cobalt)	8,566	9,550
Matte, nickel matte (79 percent nickel-cobalt)	15,708	15,649

[1] Data in terms of contained nickel plus cobalt.

Source: Mines Service of New Caledonia.

Table 6.—New Caledonia: Imports of mineral commodities

(Metric tons)

Commodity	1968	1969
METALS		
Semimanufactures, not further described	7,938	20,514
Metals, not further described	17,218	24,234
NONMETALS		
Cement	50,291	58,484
MINERAL FUELS AND RELATED MATERIALS		
Coal	236,077	199,472
Petroleum products	301,450	278,918

TRADE

Exports of mineral commodities totaled $126 million, an increase of $24 million over 1968 exports. Essentially, all the ore exported was shipped to Japan (3,064,000 tons), along with 5,763 tons of matte. More than 90 percent (21,839 tons) of the ferronickel and 52 percent (8,198 tons) of the matte exported went to metropolitan France.

COMMODITY REVIEW

Metals.—*Nickel.*—The lateritic nickel ore mined in New Caledonia is predominantly the silicate type rather than a limonitic ore as in Cuba. New Caledonian ore occurs as a greenish-yellow to brown earthy material of weathered serpentinite often with decomposing boulders, and a richer green garnierite occurring in veinlets in the serpentinite. Reserves of nickel-bearing material have been estimated at nearly 1.5 billion tons grading from 1 to 5 percent. Le Nickel, the major company, operates the local smelting plant at Noumea and mines the major portion of the ore. The ore for export to Japan comes mainly from that produced by a dozen or so small operators. Le Nickel's Thio mine on the east coast of the island is situated on a mountainside plateau facing the sea where mechanical equipment mines benches by open pit methods. Transport of screened ore to the coast is by truck, belt conveyor, and finally by an aerial cable tramway 4.9 kilometers long. At the coast, ore is loaded on a ship and carried 177 kilometers around the southern tip of the island to Le Nickel's Doniambo smelter at Noumea. Part of the ore is charged into low shaft blast furnaces at the smelter with coke, gypsum, and limestone to produce nickel-iron matte, and the iron is removed in converters to produce nickel matte. In another part of the smelter, ore is charged into electric furnaces to produce crude ferronickel which is further refined in converters to ferronickel pigs for the market. The nickel matte is either marketed or shipped to Le Nickel's plant at Le Havre, France, for further refining and conversion to nickel oxide or metal rondelles. Ore from a lower grade deposit at Poro is first crushed, upgraded, and agglomerated at a new pelletizing plant before shipping to the smelter.

The French Government is greatly interested in increasing the output of nickel from New Caledonia and has subsidized expansion of existing facilities, approved the formation of international companies and made mining concessions available to interests other than Le Nickel. One program calls for the expansion of Le Nickel's Noumea plant for increasing ferronickel output by 30,000 metric tons annually. This will require additional electric furnaces and increasing the capacity of port loading and stocking facilities at Noumea. In a few years this should increase Doniambo's total productive capacity to about 70,000 tons yearly. This $120 million investment program will be partly financed by Kaiser Aluminum and Chemical Corp.

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with which Le Nickel has formed two subsidiaries (Société Caledonienne du Nickel and Kaiser-Le Nickel Corp.). Concessions have been made to The International Nickel Company of Canada (Inco), American Metal Climax Inc. (Amax), and the Patino Mining Corp. of Quebec. An agreement signed in March 1969 established a second nickel company in New Caledonia. This is the Compagnie Française Industrielle et Minière du Pacifique (Cofimpac), which is made up of Inco and a consortium of French interests, the Société Auxiliare Miniere du Pacifique (Samipac). Samipac includes Bureau de Récherches Géologiques et Minières (BRGM), 30 percent; and Ugine-Kuhlmann, Chatillon-Commentary, Mokta, Schneider, Banque de Paris and des Pays Bas, and the Indochina and Suez Banks, 30 percent. Inco has a 40 percent interest. Cofimpac holds about 25 percent of New Caledonia's laterite reserves and plans to establish a 45,000-ton-per-year nickel operation treating low-grade ore in the southern part of the island. Nickel will be marketed on a 50-50 basis between Inco and Samipac. Considerable exploration work has been done, and tests are being made on the ore by Inco, but until a suitable metallurgical process is developed for this ore, commercial production will be delayed, possibly until about 1974. In the meantime Cofimpac has been investigating garnieritic ore deposits in the north. In October 1969, Le Nickel submitted plans to the French Government for setting up a consortium of New Caledonian interests and the Patino Mining Corp. of Canada to establish a ferronickel plant and to develop low-grade garnierite at Poum in the northern part of the island. This will be partly financed by Le Nickel's expansion program and will be subsidized by France. Le Nickel will have a 51-percent interest, Patino will have a 30-percent interest, and 19 percent of the Poum venture will be available to New Caledonian interests. The Poum project will include the construction of the plant, a town, and a port and will be done by Kaiser. Patino holds over 100 million tons of ore reserves in New Caledonia, including 50 million tons of 2-percent ore at Poum. Ore feed will come from Patino and a number of local mining companies. It is anticipated that, by 1972, 40,000 tons of ferronickel will be produced by the Poum plant. Approval is being sought from the French Government to form another company made up of Amax and Société Minière et Métallurgique de Peñarroya, S.A., a French mining company controlled by Le Nickel, to start developing nickel deposits in 1973, with production scheduled for 1975 at a rate of 45,000 tons per year.

If all the potential nickel projects are brought to production, the island should have a maximum annual capacity of about 240,000 tons of nickel plus cobalt by the late 1970's.

NEW HEBRIDES

Within a year after shutdown, the Forari mine on Efate Island of the New Hebrides is again scheduled to be reopened. Between 1961 and the end of 1968, the mine was an important sector of the economy of the Condominium of New Hebrides (governed jointly by France and the United Kingdom), producing manganese ore and agglomerates. Exports were almost entirely to Japan. Production and exports for the last 3 years of production were as follows:

Year	Metric tons	
	Production	Exports
1966	76,240	65,145
1967	71,400	72,746
1968 •	55,000	45,000

• Estimate.

In December 1968, the former owner of Forari (Compagnie Française des Phosphates de l'Oceanie) discontinued operations and sold the mine to Le Manganese de Vate (LMV). The mine was examined during the year by Consolidated Gold Fields Australia Ltd, but the reserves were considered too limited for their operations. Calculations of Forari's reserves by an independent body for Southland Mining Ltd. of Fiji disclosed 300,000 tons of 42-percent manganese ore and was sufficient to induce Southland to obtain a 50-percent interest in LMV by late 1969. Southland anticipates that LMV will mine 60,000 tons annually and expects an initial shipment of 10,000 tons by April 1970 to Japanese buyers.

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PAPUA AND NEW GUINEA

Mineral output of the Australian administered territories of Papua and New Guinea (PNG) during 1969 consisted mainly of small amounts of gold and silver with a value of $936,300.[4] In contrast to this small production, mineral activity and interest continued strong in PNG, which, in addition to the main island, comprises the islands of Bougainville, New Britian, New Ireland, Manus, and Misima, and many smaller islands. This interest and new discoveries of ore deposits promise a large-scale increase in mineral output in the near future. The recently discovered copper orebody now under rapid development at Panguna Flats, Bougainville, is one of the largest operations of its kind in the world. In this operation alone, starting in 1972, it is expected that 26 million tons of ore will be mined annually to produce about 122,000 metric tons of copper and possibly 500,000 ounces of associated gold with a total gross value of around $179 million. During 1969 a new copper prospect was discovered in a remote part of western Papua. This find is being evaluated and appears to be high grade but somewhat smaller than the deposit at Panguna Flats. If it proves to be an economic operation, its contribution to PNG's mineral production probably will not be seen for 3 or 4 years.

Activity in oil search continues, but thus far the best wells have produced only gas and some condensate.

PRODUCTION

Mineral production for Papua and New Guinea for recent calendar years follows:

Minerals	1967	1968	1969
Copper---metric tons--	------	------	1
Gold-----troy ounces--	27,671	26,144	25,857
Silver----------do----	17,176	18,139	17,206

COMMODITY REVIEW

Metals.—*Copper.*—In early 1969, Bougainville Copper Pty. Ltd. (BCP) completed diamond drilling and outlining its porphyry copper deposit on Bougainville Island. Final assays and current estimates of grade of the deposit were obtained from core samples and confirmed by bulk sampling, which is continuing. BCP is owned two-thirds by Conzinc Rio Tinto of Australia Ltd. (CRA) and one-third by New Broken Hill Consolidated Ltd. and is the most extensive proving and evaluation exercise in which this group has ever been engaged. Together, the partners spent over $16 million on the project in 1968, and it is estimated that the cost to bring the mine-concentrating complex into production will be around $300 million. The Bougainville Mining Ordinance provides that 20 percent of the equity will be offered to the Administration on behalf of the local people. Other provisions include a royalty of 1¼ percent of f.o.b. sales, and a maximum tax rate of 50 percent.

Located at Panguna Flats, the deposit lies slightly south of the island's center, 16 kilometers from the east coast and at an elevation of 610 meters in the Crown Prince mountain range. Copper mineralization is confined to intrusive stocks in volcanics and their contact zones. The ore minerals (chalcopyrite and bornite) occur in fine fractures and quartz veinlets which form a close stockwork in the orebody and contain a little gold and traces of molybdenite. Weakly mineralized areas are characterized by sparser veining. The higher grade portion of the deposit has been estimated to contain 772 million metric tons containing 0.47 percent copper and 0.02 troy ounce of gold per ton, and bulk sampling indicates that this estimate is conservative. An additional 400 million tons of lower grade ore is adjacent to the main body. Because of the low grade, it will be necessary to operate at a high throughput rate to make exploitation economically feasible. BCP plans to use open pit mining methods, which will require the removal of up to 37 meters of overburden, but first will probably clear sites and construct a concentrator and other permanent buildings. Reportedly, the concentrator will include conventional crushing and grinding followed by flotation, but the high cost of shipping steel balls may dictate the use of autogenous or semiautogenous grinding. It is likely that the concentrator will be designed to treat 81,000 tons of ore daily and produce more than 122,000 tons of contained copper annually. Other planned de-

[4] Where necessary, values have been converted from Australian dollars (A$) to U.S. dollars at the rate of A1=US$1.12.

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velopments require the construction of a port at Anewa Bay north of the town of Kieta, and a pipeline to carry concentrate slurry to the port for stockpiling and shipment.

An agreement was finalized in July between BCP and seven Japanese smelters (Dowa, Furukawa, Mitsubishi, Mitsui, Nippon, Sumitomo, and Toho) for which BCP will supply concentrate containing 965,000 tons of copper during 15 years starting in 1972 (81,000 tons annually the first 10 years and 31,000 tons during each of the last 5 years). The copper will be valued at the then-existing free world price or a minimum of $0.30 per pound. This sale accounts for about half of BCP's output, and at present copper prices has a total gross value of over $1 billion. The smelters also will recover 5 to 6 tons of gold annually from the concentrate and pay for it at international gold market prices less cost of recovery. Letters of intent were also signed with two European companies during the year; one for the sale of 53,000 tons of contained copper annually to the German smelter, Norddeutsche Affinerie, and one for 15,000 tons yearly to the Spanish company, Compania Española de Minas de Rio Tinto, SA.

Continued interest was shown in the old Astrolabe copper-gold field during 1969. Reportedly 320,000 tons of 5.2-percent copper ore have been proven at Laloki in an old mining area 27 kilometers from Port Moresby, and plans have been made to form a new company to develop the ore which also contains 0.21 ounce of gold and 0.5 ounce of silver per ton.

Following the finding of encouraging copper anomalies by Pacific Island Mines Ltd. on Misima Island last year, the company planned to diamond-drill those areas of high geochemical value at depth during 1969. About seven holes 300 meters deep were scheduled.

During mid-1969 the Kennecott Copper Corp. announced the find of a high-grade copper prospect in the remote mountain area of Papua near the West Irian border which seems to be both large and promising. Company officials expect that an adequate evaluation of the find will take 2 years. Located at the headwaters of the Ok Tedi River in the Star Mountains, the prospect is on the Fubilan, a mountain 2,200 meters high containing disseminated copper ore that may run into several hundred million tons. The prospect is being drilled and samples analyzed. Grade may run between 0.5 and 2.5 percent copper. Other large mining companies, including CRA, are also prospecting in the area.

On Manus Island, Exoil N.L. and Transoil N.L. have outlined two large copper geochemical anomalies and located pebbles containing copper carbonates in the vicinity of the anomalies. Stream sediment and soil sampling surveys have been expanded, and an extensive drilling program is planned for 1970.

Gold.—In the Kainantu District of New Guinea, Highland Gold Development N.L. had begun prospecting and reportedly planned drilling operations on the Kathnel gold deposit after mid-1969.

Iron Sands.—James Wallace Exploration Pty. Ltd. has been exploring the magnetite sands in the deltas of the Gulf of Papua and has obtained a favorable report on the area from an independent consulting firm. A detailed exploration and development program will be undertaken as a result of this report.

Nickel.—A lateritic nickel deposit, 64 kilometers from the coast near Madang, tested by Metals Exploration N.L. appears to have portions that can be upgraded.

Mineral Fuels.—*Petroleum and Natural Gas.*—Following the strike in Pasca No. 1 well by about 6 months, a further offshore gas-condensate strike was made by Phillips Australian Oil Co. in Pasca A2, a similar producer, in February 1969. Pasca A2 in the Gulf of Papua is 80 kilometers offshore.

In midyear, Basin Oil N.L. as the operator with Reef Oil and two United States Companies (Continental Oil and Marathon Petroleum), reported a gas blowout of their first wildcat well in Papua, Tovala No. 1.

As planned in 1968, a seismic survey for Interstate Oil Ltd. was completed by Australasian Petroleum Co. and evaluated. Based on the survey, Australasian chose a test well site (Ipigo No. 1) in the Gulf of Papua, 2.5 kilometers from the banks of the Pie River in swampy terrain. Spudding in was expected to be done early in 1970 by Oil Search Ltd. Other partners are British Petroleum and Mobil.

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TONGA

The Kingdom of Tonga, comprised of a number of coral limestone islands (the Friendly Isles), extends northeastwards from its main island of Tongatapu for about 320 kilometers in a narrow band. The islands are well scattered; the largest, Tongatapu, measures only about 16 by 32 kilometers, and lies about 750 kilometers southeast of Fiji. A British protectorate in 1969, it was anticipated that the Kingdom would become a fully independent Nation and join the British Commonwealth by June 1970.

An offshore seepage at Eua, an island near Tongatapu, was first identified as an hydrocarbon in September 1968; 2 months later additional oil shows were recognized around Nuku'alofa, the capital of Tongatapu. Inspection of oil samples from these shows indicated its low gravity, contained gases, and absence of sulfur. Interest was aroused, and in hope that an oil discovery would be made, the Tongan Government amended the Mineral Act of 1949 in late 1968 and asked for exploration bids. An early deadline for closing oil bids was set by King Taufa'aukau, but was later extended to January 1969. Speculations were made that if the Lau Basin, to the west of Tonga, could be the site of oil formation, oil accumulation might also be found in the Lau Islands of the Fiji group. Initial applications for exploration rights were made by Shell, British Petroleum, Mobil, Aquitaine, Magellan, and Republic Mineral Corp. of Texas. Through most of 1969, the Tongans were indecisive regarding which applicant should get the exploration rights, but by yearend 1969 indications were that the Government of Tonga would probably grant rights for onshore and offshore exploration to a consortium made up of Tonga Shell, Australian Aquitaine Petroleum Pty. Ltd., British Petroleum Development Co. Ltd., Gulf Oil of Tonga, Republic Mineral Corp., and Ampol.

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